



## **DEPARTMENT OF THE INTERIOR**

### **Fish and Wildlife Service**

#### **50 CFR Part 17**

**[Docket No. FWS–R3–ES–2013–0089; 4500030113]**

### **Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Rattlesnake-Master Borer Moth (*Papaipema eryngii*) as an Endangered or Threatened Species**

**AGENCY:** Fish and Wildlife Service, Interior.

**ACTION:** Notice of 12-month petition finding.

**SUMMARY:** We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list the rattlesnake-master borer moth (*Papaipema eryngii*) as an endangered or a threatened species under the Endangered Species Act of 1973, as amended (Act). After review of the best available scientific and commercial information, we find that listing the rattlesnake-master borer moth is warranted. Currently, however,

listing the rattlesnake-master borer moth is precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants. Upon publication of this 12-month petition finding, we will add the rattlesnake-master borer moth to our candidate species list. We will develop a proposed rule to list the rattlesnake-master borer moth as our priorities allow. In any interim period, we will address the status of the candidate taxon through our annual Candidate Notice of Review (CNOR).

**DATES:** The finding announced in this document was made on [INSERT DATE OF FEDERAL REGISTER PUBLICATION].

**ADDRESSES:** This finding is available on the Internet at <http://www.regulations.gov> at Docket Number **FWS–R3–ES–2013–0089**. Supporting documentation we used in preparing this finding is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, 1511 47<sup>th</sup> Ave, Moline, IL 61265. Please submit any new information, materials, comments, or questions concerning this finding to the above street address.

**FOR FURTHER INFORMATION CONTACT:** Richard C. Nelson, Field Supervisor, Rock Island Field Office (see **ADDRESSES**); by telephone at 309–757–5800; or by facsimile at 309–757–5807 <mailto:>. If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800–877–8339.

**SUPPLEMENTARY INFORMATION:**

## Background

Section 4(b)(3)(B) of the Act (16 U.S.C. 1531 *et seq.*) requires that, for any petition to revise the Federal Lists of Endangered and Threatened Wildlife and Plants that contains substantial scientific or commercial information that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition. In this finding, we will determine that the petitioned action is: (1) Not warranted; (2) warranted; or (3) warranted, but the immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether species are endangered or threatened, and expeditious progress is being made to add or remove qualified species from the Federal Lists of Endangered and Threatened Wildlife and Plants. Section 4(b)(3)(C) of the Act requires that we treat a petition for which the requested action is found to be warranted but precluded as though resubmitted on the date of such finding, that is, requiring a subsequent finding to be made within 12 months. We must publish these 12-month findings in the **Federal Register**.

### *Previous Federal Actions*

On June 25, 2007, we received a formal petition dated June 18, 2007, from Forest Guardians (now WildEarth Guardians), requesting that the rattlesnake-master borer moth be listed as either endangered or threatened under the Act with critical habitat.

The petitioner incorporated into the petition all analyses, references, and documentation provided by NatureServe in its online database at <http://www.natureserve.org/>. The petition clearly identified itself as a petition and included the appropriate identification information, as required in 50 CFR 424.14(a). We sent a letter to the petitioner dated July 11, 2007, acknowledging receipt of the petition and stating that the petition was under review by staff in our Southwest Regional Office. On March 19, 2008, WildEarth Guardians filed a complaint indicating that the Service failed to comply with its mandatory duty to make a preliminary 90-day finding on the June 18, 2007, petition to list 475 southwest species. We subsequently published an initial 90-day finding for 270 of the 475 petitioned species on January 6, 2009, concluding that the petition did not present substantial information that listing of those species may be warranted (74 FR 419). On March 13, 2009, the Service and WildEarth Guardians filed a stipulated settlement agreement, agreeing that the Service would submit to the **Federal Register** a finding as to whether WildEarth Guardians' petition presents substantial information indicating that the petitioned action may be warranted for the remaining southwestern species by December 9, 2009. On December 16, 2009, we published a 90-day finding that the petition presented substantial scientific or commercial information indicating that listing may be warranted for 67 species, including the rattlesnake-master borer moth (74 FR 66866).

This notice constitutes the 12-month finding on the WildEarth Guardians' petition to list the rattlesnake-master borer moth as an endangered or threatened species.

#### *Species Information*

## Taxonomy and Species Description

The rattlesnake-master borer moth is a member of the family Noctuidae (owlet moths) and was first described in 1917 from individuals collected near Chicago, Illinois (Bird 1917, pp. 125–128). The genus *Papaipema* contains 53 species, all of which are found in North America and are root or stem boring (Schweitzer *et al.* 2011, p. 349; Panzer 1998, p. 48). Rattlesnake-master borer moth is the accepted common name for *Papaipema eryngii*.

The adult rattlesnake-master borer moth measures 3.5–4.8 centimeters (cm) (1.4–1.9 inches) (Bird 1917, p. 125). It has a smooth head with simple antennae and a tufted body (Forbes 1954, p. 191, Bird 1917, p. 125). The forewing is rich purple brown to red brown becoming lighter and showing yellow powderings near the inner margin, a yellowish white dot at the base, and a powdery yellow patch at the apex (Bird 1917, p. 125). The middle of the forewing contains several distinct white and yellow spots (Bird 1917, p. 125). The hind wing is duller than the forewing and is described by Bird (1917, p. 125) as smoky fawn overlaid with dark purplish powderings becoming darker at the margin. Male rattlesnake-master borer moths have distinctively identifiable genitalia, which allow distinction from other *Papaipema* moths of similar appearance (Forbes 1954, p. 193; Bird 1917, p. 126). Rattlesnake-master borer moth larvae develop in five instars, all of which have a yellowish head and are deep purplish brown with longitudinal white lines that are broken over the first four abdominal segments (Hessel 1954, p. 62; Bird 1917, p. 127).

### *Life History*

Rattlesnake-master borer moths are univoltine (having a single flight per year) with adults emerging from mid-September to mid-October, and flying through mid- to late October or when the weather becomes too cold (Derkovitz 2013, pers. comm.; Hessel 1954, p. 59; Forbes 1954, p. 198; Bird 1917, p. 128). Their nocturnal habits make them hard to observe, thus adults feeding habits are unknown. Based on their short adult flight span, their underdeveloped mouth parts, and the large amount of stored fat, researchers postulate that they likely do not need much for nectar sources and likely use dew or oozing sap for imbibing moisture (Wiker 2013, pers. comm.). Adults will drink from sugar water when held in captivity (LaGesse 2013, pers. comm.). Based on their coloring, researchers believe the moths likely spend their days attached to plants or on the bottom of leaves, where their presence is camouflaged (Wiker 2013, pers. comm.).

In mid-October, females drop their eggs in the vicinity of the food plant, *Eryngium yuccifolium* (rattlesnake-master), where the eggs overwinter in the duff; young larvae emerge between mid-May and early June (Derkovitz 2013, pers. comm.; LaGesse *et al.* 2009, p. 4; Bird 1917, p. 126). Rattlesnake-master borer moths are monophagous (have only one food source), with larvae feeding exclusively on rattlesnake-master (Panzer 2003, p. 18; Hessel 1954, p. 59; Forbes 1954, p. 198; Bird 1917, p. 124). When larvae first emerge, they feed on the leaves of the host plant and the second instars burrow into the stem (or root) and on into the root where they remain until they pupate in mid- to late August (Derkovitz, pers. comm. 2013; LaGesse *et al.* 2009, p. 4; Bird 1917, p. 127). During the time that the larvae are actively boring into the host plant,

researchers have detected cannibalistic behavior with some caterpillars moving into already occupied bore holes, killing the occupant and pushing them back out (LaGesse *et al.* 2009, p. 4). Rattlesnake-master borer moths diapause in the chamber they create in the host plant and pupation appears to take place either inside the chamber or in the soil and lasts 2–3 weeks (Derkovitz 2013, pers. comm.; LaGesse *et al.* 2009, p. 4; Bird 1917, p. 127). The boring activities of the rattlesnake-master borer moth generally result in the plant not producing a flower and can be fatal to the host plant (Wiker 2013, pers. comm.; LaGesse *et al.* 2009, p. 4).

Although there are no specific data on their home range, rattlesnake-master borer moths are not thought to disperse widely and have been described as “relatively sedentary” (LaGesse *et al.* 2009, p. 4; Panzer 2003, p. 18;). Panzer (2003, p. 19) found that female rattlesnake-master borer moths dispersed up to 120 meters (m) (394 feet (ft)) from where they were released and some traversed a 25-m (82-ft) gap that was devoid of host plants. LaGesse *et al.* (2009, p. 4) indicate that rattlesnake-master borer moths will disperse up to 2 miles (3-6 kilometers (km)) if the number of host plants is limiting.

### *Habitat*

Rattlesnake-master borer moths are obligate residents of undisturbed prairie and woodland openings that contain their only food plant, rattlesnake-master (Schweitzer *et al.* 2011, p. 351; LaGesse *et al.* 2009, p. 4; Panzer 2002, p. 1298; Molano-Florez 2001, p. 1; Panzer *et al.* 1995, p. 115; Mohlenbrock 1986, p. 34; Hessel 1954, p. 59; Forbes 1954, p. 198; Bird 1917, p. 124). Although common in remnant prairies, rattlesnake-master occurs in low densities; it is a conservative species and has been found to have relative

frequencies in restored and relict prairies of less than 1 percent (Danderson and Molano-Flores 2010, p. 235; Molano-Flores 2001, p. 1). The range of rattlesnake-master covers much of the eastern United States and spans from Minnesota south to Texas, east to Florida and back north to Connecticut (U.S. Department of Agriculture (USDA) Plants website 2013, <http://plants.usda.gov/java/>; Danderson and Molano-Flores 2010, p. 235). Although the plant has an expansive range, the loss of its tallgrass prairie habitat within that area is estimated to be between 82–99 percent (Samson and Knopf 1994, p. 418). Most high-quality prairies that remain are small and scattered across the landscape (Robertson *et al.* 1997, p. 63). In 1997, Robertson *et al.* (1997, p. 63) cited the Illinois Natural Areas Inventory, which found that of the 253 grade A and B (high-quality) prairies identified, 83 percent were smaller than 10 acres (4 hectares) and 30 percent were smaller than 1 acre (0.4 hectares). Most prairie destruction occurred between 1840 and 1900 (Robertson *et al.* 1997, p. 63).

### *Distribution and Status*

All but one of the currently known rattlesnake-master borer moth sites have been identified since 1994. Little historical data exists for this species from before 1994. Some, but not all, of the sites have had some subsequent survey work to monitor individual populations.

Surveys for rattlesnake-master borer moths are conducted for both the adult and larval stage. Surveying for adult moths can be limiting, due to their sedentary nature, relatively short flight time, and the potential difficulties of surveying at night when the moths are active (LaGesse 2013, pers. comm.; Schweitzer *et al.* 2011, p. 19; LaGesse *et*

*al.* 2009, p. 7; Metzler *et al.* 2005, p. 59). The usual survey method for *Papaipema* moths is with blacklight traps, although some researchers have found that rattlesnake-master borer moth may not be attracted to blacklights (LaGesse 2013, pers. comm.; LaGesse *et al.* 2009, p. 4). It is difficult to determine population size based on capture of adults, due to their irregular attraction to blacklights and the difficulty of designing a study that would factor in how many adults may be flying at a given time and how far they may range (LaGesse 2013, pers. comm.; Schweitzer *et al.* 2011, p. 19; LaGesse *et al.* 2009, p. 7).

Larval surveys are conducted by searching the host plant for signs of boring (LaGesse *et al.* 2009, p. 7). Rattlesnake-master show signs of stress that indicate the occupancy of the root by rattlesnake-master borer larvae, which usually leave a pile of frass (excrement) below the bore hole (LaGesse 2013, pers. comm.; Hall 2012, pers. comm.). One benefit of larval surveys is that these surveys can be conducted for a longer time because evidence of larval infestation remains even after emergence (Schweitzer *et al.* 2011, p. 13). Researchers will often collect rattlesnake-master borer moth larvae and rear them to adulthood to confirm identification, as other similar species have been found in rattlesnake-master (such as the silphium borer moth (*Papaipema silphii*)) (Wiker 2013, pers. comm.). Much of the available census data for rattlesnake-master borer moths does not indicate the size or stability of the populations, but indicate only the continued presence or absence of the species in a specific area.

The rattlesnake-master borer moth is currently known to occur in five States: Illinois, Arkansas, Kentucky, North Carolina, and Oklahoma. Given that its food plant ranges across 26 States (USDA Plants website 2013, <http://plants.usda.gov/java/>), it is

likely the rattlesnake-master borer moth's historical range was larger than at present; however, not much data supports its presence in other Midwest States. There are no historical records and no known records of rattlesnake-master borer moth in Indiana, although surveys have been conducted at several sites where the host plant occurs (Okajima 2012, pers. comm.). In Missouri, experts have examined numerous *Papaipema* specimens without finding any collections of rattlesnake-master borer moth (McKenzie 2012, pers. comm.). Experts indicate that, given the abundance of the host plant in Missouri, the species possibly occurs in Missouri and has not been detected (McKenzie 2012, pers. comm.). There are also no historical or known records for Iowa (Howell 2013, pers. comm.). Below we present specific occurrence information across the 5 States where the species is currently known to occur.

### *Illinois*

The State of Illinois has the most rattlesnake-master borer moth sites. At this time, 10 known sites contain rattlesnake-master borer moths in 8 Illinois counties (Will, Cook, Grundy, Livingston, Kankakee, Marion, Effingham, and Fayette). Nine of the known sites are thought to have extant populations and one is unknown. When Bird (1917, p. 124) first described the species, specimens were collected from the Chicago area, and five of the sites with extant populations are still found close to the city of Chicago (Will, Cook, Grundy, Livingston, and Kankakee Counties). There are two known sites in Will County—one of these sites is owned by the Illinois Department of Natural Resources (IDNR) and is extant, and the other is in railroad siding in private and State ownership and its population status is unknown. The population of rattlesnake-

master borer moths within the IDNR site is thought to be stable (Derkovitz 2013, pers. comm.) Surveys of both adults and larvae have been conducted on this site, with the most recent larval survey in 2012 (Derkovitz 2013, pers. comm.). This Will County site is protected and managed with prescribed burning to control woody species (Derkovitz 2013, pers. comm.). Although researchers have not found a decline of the moths within this site, poachers have removed individuals in the past and the location of the population is kept undisclosed for this reason (Derkovitz 2013, pers. comm.). Based on this information, we consider the status of the species to be extant on this site.

Larval surveys were conducted at the second Will County site (the railroad siding site), with presence last confirmed in 1997 (Illinois Natural Heritage Database 2012). This site was described by researchers as being very small and with few host plants when it was surveyed in 1997 (Derkovitz 2013, pers. comm.). The population of rattlesnake-master borer moths on this site is under private ownership of the railroad, however, it is contiguous with an Illinois State Nature Preserve (Derkovitz 2013, pers. comm.). During a larval survey in 2008, researchers found no signs of rattlesnake-master borer moths and suggested they may be extirpated from the site (Illinois Natural Heritage Database 2012). Based on this information, we consider the status of the species on this site to be unknown.

The presence of rattlesnake-master borer moths was confirmed on three other railroad siding prairies, one each in Livingston, Kankakee, and Grundy Counties (Illinois Natural Heritage Database 2012). The information on the Kankakee railroad siding is limited, although the species was confirmed on the site in 1997 (Illinois Natural Heritage Database 2012). Not much is known about the Livingston County site since the presence

of the moth was detected here in 2001, as there have been no other known surveys of the site (Illinois Natural Heritage Database 2012). Larvae were first detected on the Grundy County railroad siding in 1997, and presence of the species at the site was most recently confirmed in 2012 (Derkovitz 2013, pers. comm.) Like the railroad siding prairie in Will County, these three sites are in private ownership and the unmanaged populations are considered extant at these sites.

A second site owned by the Illinois DNR is located in Grundy County. The rattlesnake-master borer moth was first found in this site in 1990, with subsequent surveys in 1991, 1993, 1995, 1996, and 2003 (Illinois Natural Heritage Database 2012). Although an extensive survey of the population has not been done on this site, it is protected and managed, with the last prescribed burn occurring in 2011 (Derkovitz 2013, pers. comm.). Poaching of rattlesnake-master borer moths has occurred on this site, and so the location of the population is kept undisclosed (Illinois Natural Heritage Database 2012). The rattlesnake-master borer moth population on this Grundy County site is considered to be extant.

One other known population of rattlesnake-master borer moth close to Chicago occurs in Cook County, with rattlesnake-master borer moths introduced to the site in 1998 (Derkovitz 2013, pers. comm.; Illinois Natural Heritage Database 2012). This site is owned and managed by Northeastern Illinois University and larval surveys have been conducted each year since it was introduced to the site (Derkovitz 2013, pers. comm.). Area managers have found that the rattlesnake-master borer moths within this area are scattered into several small populations that have stayed approximately the same size since 1998 (Derkovitz 2013, pers. comm.). This site is considered to have an extant

population.

In 2008, populations of rattlesnake-master borer moths were found for the first time in Marion and Effingham Counties in southern Illinois (LaGesse and Wiker 2008, pp. 7–8). The presence of the moth was confirmed at three sites through larval surveys; two sites within IDNR prairie areas in Marion County, and one within scenic right-of-way sections of a privately owned railroad siding that spans through Marion and Effingham Counties (LaGesse and Wiker 2008, pp. 7–8). The railroad prairie is a large, linear prairie that covers approximately 64 hectares (158 acres) (Dietrich *et al.* 1996, p. 2). Of the two IDNR owned properties, one is a 65-hectare (160-acre) relict prairie area and the other is a 16 hectare (40-acre) prairie restoration, which contains the only known rattlesnake-master borer moth population that is not in a relict habitat area (LaGesse *et al.* 2009, p. 5). The number of bored rattlesnake-master plants was estimated to be between 200–250 on one IDNR site and the other contained between 250–300 bored plants (LaGesse and Wiker 2008, pp. 7–8). The railroad site contained between 5 and 10 bored plants (containing evidence of larval boring) and 15–20 bored plants (LaGesse and Wiker 2008, pp. 7–8).

In 2009, researchers returned to each of these sites to map and estimate the populations and establish monitoring protocols (LaGesse *et al.* 2009, p. 3). Survey methods included marking and outlining the perimeter of each rattlesnake-master subpopulation, flagging all plants that had signs of being bored by rattlesnake-master borer moths, and mapping the locations (LaGesse *et al.* 2009, p. 5). Individual plants that had evidence of rattlesnake-master borer moth damage were counted within each subpopulation, except for one subpopulation that was too large for such a count (LaGesse

*et al.* 2009, p. 5). A sampling method was established to estimate the population within this large population of rattlesnake-master (LaGessee *et al.* 2009, p. 5). Researchers surveyed 67 subpopulations of rattlesnake-master across the 3 sites discovered in 2008 and found that 33 were inhabited by rattlesnake-master borer moths (LaGessee *et al.* 2009, p. 5). Although some populations were probably undetected, they estimated the overall population of rattlesnake-master borer moths to be approximately 4,600 (LaGessee *et al.* 2009, p. 6).

Management is conducted on all three of these sites in order to conserve and sustain the prairie communities. Prescribed fire is used on all of the sites, and the 65-hectare (160-acre) IDNR area also includes grazing to stimulate structural openings for prairie birds (LaGessee *et al.* 2009, p. 5). Researchers found that the grazing practices likely did not impact the rattlesnake-master borer moth population (see Factor A and E discussion in this finding). All three of the sites in southern Illinois are considered to contain extant populations.

In 2009, an application of herbicide affected populations of rattlesnake-master in the railroad siding prairie (LaGessee and Walk 2010, unpaginated). Consequently, in 2010 researchers surveyed the railroad prairie areas using the same techniques from 2009 in order to estimate and map the population of rattlesnake-master and rattlesnake-master borer moths and compare them to the findings from 2009 (LaGessee and Walk 2010, unpaginated). LaGessee and Walk (2010, unpaginated) found that 2 rattlesnake-master populations were completely destroyed and 19 declined between 2009 and 2010. Researchers found that both the overall population of rattlesnake-master and the density of the plants declined (LaGessee and Walk 2010, unpaginated).

Fourteen populations of rattlesnake-master borer moths with a total of 112 caterpillars were detected in 2010 (LaGesse and Walk 2010, unpaginated). One-third of the nine populations of rattlesnake-master borer moths surveyed in 2009 declined; however, nine new populations were identified during the 2010 survey (LaGesse and Walk 2010, unpaginated). Due to an expanded survey area, researchers also identified an additional 24 populations of rattlesnake-master during the 2010 survey in Marion, Fayette, and Effingham Counties (LaGesse and Walk 2010, unpaginated). Within these new stands of rattlesnake-master, they found 7 new populations of rattlesnake-master borer moths with a total of 41 caterpillars. The five populations of rattlesnake-master borer moth identified within Fayette County in 2010 were the first recorded occurrence of the moth for this county (LaGesse and Walk 2010, unpaginated). Although evidence of boring was found in rattlesnake-master in Fayette County in 2009, the areas were subsequently flooded due to heavy rain events (LaGesse and Walk 2010, unpaginated).

### *Kentucky*

The rattlesnake-master borer moth is known from two sites in Kentucky, one each in Christian and Hardin Counties. The Christian County site is known from a single occurrence prior to 1999, but researchers have not found any sign of boring in rattlesnake-master in recent years (Laudermilk 2012, pers. comm.). The succession to woody plants has changed the composition of the plant community on site and experts believe that rattlesnake-master borer moth has been extirpated from the site (Laudermilk 2012, pers. comm.). The Hardin County site is thought to be extant based on larval counts dating back to 2003, with researchers finding between 100 and 500 feeding larvae

during each survey year (Laudermilk 2012, pers. comm.). A comprehensive survey in 2008 indicated the largest number of feeding larvae found at that site was approximately 500. The site has a wide distribution of rattlesnake-master, although the moth has shown a clumped distribution (Laudermilk 2012, pers. comm.). This site is secure and its population considered extant, although its location is undisclosed due to concern of collection of the species.

### *Arkansas*

The rattlesnake-master borer moth was first discovered on two sites in Arkansas in 1997, one each in Pulaski and Jefferson Counties (Weaver and Boos 1998, p. 8; Weaver and Boos 1997, p. 8). The Jefferson County site is located on the Pine Bluff Arsenal, where populations of the species were found in dry mesic savanna remnants (Zollner 2013, pers. comm.; Weaver and Boos 1998, p. 8). Researchers found the rattlesnake-master borer moths in small subpopulations of 3–12 individuals scattered throughout the patches of rattlesnake-master within the savanna remnants (Weaver and Boos 1998, p. 9). Surveys were also conducted within a railroad prairie on the Arsenal containing many rattlesnake-master plants, but the moth was not found there; it has not been found since the 1997 survey and researchers suggested that the fire regime in this area may be suppressing the colonization of this area by the moth (Zollner 2013, pers. comm.; Weaver and Boos 1998, pp. 16–17). Since the 1997 survey, one of the areas containing rattlesnake-master borer moths has been developed and an incinerator built on the area (Zollner 2013, pers. comm.). The other savanna remnants remain and have been surveyed for evidence of rattlesnake-master borer moth larva every year since it was

discovered (Zollner 2013, pers. comm.). These annual surveys indicate that the population has stayed stable with generally the same number of larvae found, but always fewer than 20 individuals (Zollner 2013, pers. comm.). This area is managed yearly with rotational prescribed burning, usually before April 15 (Zollner 2013, pers. comm.). The Pine Bluff Arsenal site is considered extant.

The Pulaski County site is located within a mesic prairie area on the Little Rock Air Force Base (Weaver and Boos 1997, p. 8). The 1997 survey is the only survey conducted within this site (Popham 2013, pers. comm.; Zollner 2013, pers. comm.). Because of its proximity to the airfield and implementation of Bird Aircraft Strike Hazard rules, the prairie is mowed annually, which is the same management regime conducted onsite when rattlesnake-master was found in 1997 (Popham 2013, pers. comm.). Rattlesnake-master is known to occur in other areas of the Air Force Base; however, this prairie remnant is the only area where the moth has been detected (Popham 2013, pers. comm.) The status of the population and the prairie area on the Air Force Base is unknown.

### *Oklahoma*

One known location of rattlesnake-master borer moth is in Oklahoma, in Osage County (LaGesse 2013, pers. comm.). During surveys conducted between 2000 and 2005, three populations were found within The Nature Conservancy's Tallgrass Nature Preserve, approximately 2–4 miles (3–6 km) apart (LaGesse 2013, pers. comm.). The first population to be studied on the Preserve had approximately 200 individuals. Later, the two other populations were found, both with approximately 50 individuals (LaGesse

2013, pers. comm.). The prairie community on the entire site is managed with grazing bison and a randomized prescribed fire regime designed to mimic the natural forces found on site prior to settlement (Hamilton 2013, pers. comm.). Although no surveys have been conducted on site since 2005, the management of the area is unchanged, so this site is considered extant.

#### *North Carolina*

Rattlesnake-master borer moth is known from a pine barrens, which is owned and managed by the State, in Pender County, North Carolina (Hall 2013, pers. comm.; Hall 2012, pers. comm.; Schweitzer *et al.* 2011, p. 351). The moth was first identified from a single adult on this site in 1994 (Hall 2012, pers. comm.; Schweitzer *et al.* 2011, p. 351). A prescribed burn was conducted on the site soon after the 1994 collection, and a subsequent survey resulted in location of one larva during the summer of 1995 (Hall 2012, pers. comm.; Schweitzer *et al.* 2011, p. 351). A 2002 survey of approximately 80–100 rattlesnake-master plants for larval feeding damage resulted in only one hole, indicating possible occupancy, however, no frass was found outside of the hole, which is a more reliable sign of larvae inhabitation (Hall 2012, pers. comm.). No surveys have occurred in the area since 2002 to verify the status of the population, so the status of the population on this site is considered unknown.

In summary, the rattlesnake-master borer moth currently occurs in five States: Illinois, Kentucky, Arkansas, Oklahoma, and North Carolina. Within these states, 16 sites have confirmed populations of the moth since 1993 (Table 1). Of these sites, 12 are

considered to be extant, 3 unknown, and 1 is considered to be extirpated. Given the range of the food plant and the relatively recent discovery of all of the known populations, the range of the moth is possibly greater within these five States and within other States where rattlesnake-master is found.

Table 1. Rattlesnake-master borer moth status at all known sites.

State	Site Description	County	Current Status	Date of Last Observation
Illinois	IDNR Site	Will	Extant	2012
Illinois	railroad siding	Will	Unknown	1997
Illinois	railroad siding	Livingston	Extant	2001
Illinois	railroad siding	Grundy	Extant	2012
Illinois	IDNR	Grundy	Extant	2003
Illinois	railroad siding	Kankakee	Extant	1997
Illinois	Northeastern Illinois University	Cook	Extant	2012
Illinois	IDNR	Marion	Extant	2009
Illinois	IDNR	Marion	Extant	2009
Illinois	railroad siding	Marion, Effingham, Fayette	Extant	2010
Kentucky		Christian	Extirpated	1999
Kentucky		Hardin	Extant	2008
Arkansas	Pine Bluff	Jefferson	Extant	2012
Arkansas	Little Rock Air Force Base	Pulaski	Unknown	1997
Oklahoma	The Nature Conservancy	Osage	Extant	2005
North Carolina	Pine Barrens	Pender	Unknown	2002

### Summary of Information Pertaining to the Five Factors

Section 4 of the Act (16 U.S.C. 1533) and implementing regulations (50 CFR 424) set forth procedures for adding species to, removing species from, or reclassifying species on the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, a species may be determined to be endangered or threatened based on any of the following five factors:

- (A) The present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) Overutilization for commercial, recreational, scientific, or educational purposes;
- (C) Disease or predation;
- (D) The inadequacy of existing regulatory mechanisms; or
- (E) Other natural or manmade factors affecting its continued existence.

In making this finding, information pertaining to the rattlesnake-master borer moth in relation to the five factors provided in section 4(a)(1) of the Act is discussed below. In considering what factors might constitute threats to a species, we must look beyond the exposure of the species to a particular factor to evaluate whether the species may respond to that factor in a way that causes actual impacts to the species. If there is exposure to a factor and the species responds negatively, the factor may be a threat and, during the status review, we attempt to determine how significant a threat it is. The threat is significant if it drives, or contributes to, the risk of extinction of the species such that the species warrants listing as an endangered or threatened species as those terms are defined in the Act. However, the identification of factors that could impact a species

negatively may not be sufficient to compel a finding that the species warrants listing. The information must include evidence sufficient to suggest that these factors are operative threats that act on the species to the point that the species may meet the definition of an endangered or threatened species under the Act.

*Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range*

Rattlesnake-master borer moths are monophagous, feeding exclusively on the prairie plant, rattlesnake-master (Schweitzer *et al.* 2011, p. 351; LaGesse *et al.* 2009, p. 4; Panzer 2002, p. 1298; Molano-Florez 2001, p. 1; Panzer *et al.* 1995, p. 115; Mohlenbrock 1986, p. 34; Hessel 1954, p. 59; Forbes 1954, p. 198; Bird 1917, p. 124). Although the overall range of rattlesnake-master is large (occurring in 26 States), the plant's relative densities in prairie are low, making up 1 percent of the prairie flora (Danderson and Molano-Flores 2010, p. 235; Molano-Flores 2001, p. 1). Rattlesnake-master is not known to occur in disturbed areas, and the extensive loss of undisturbed prairie in the United States has resulted in the remaining remnants that could support rattlesnake-master generally to be small and isolated. The rattlesnake-master borer moth's dependence on rattlesnake-master as its only larval food source makes the moth's potential habitat very narrow, which is likely limiting for this species. In their multiyear study, Panzer *et al.* (1995, p. 102) gauged the levels of remnant dependence (limited to natural area remnants) for 22 families and 6 genera of insects around the Chicago, Illinois, area and provided a list of remnant dependent species. They determined that

rattlesnake-master borer moths are highly dependent on remnant patches of native prairie, not finding them in any disturbed areas (Panzer *et al.* 1995, p. 115). The disturbed area between the widely scattered remnant prairie patches that support the remaining rattlesnake-master borer moth populations will not support their food plant, rattlesnake-master, making these expansive areas uninhabitable to the moth.

The conservation of good-quality prairie habitat is important for rattlesnake-master borer moth populations, especially those that are small and isolated, which would not be recolonized if they were extirpated. The loss of prairie habitat and the degradation and destruction of remnant habitat occurs in many ways, including but not limited to development, fire, flooding, invasive species encroachment, and succession, which are discussed in further detail below.

#### *Conversion of Prairie for Agriculture*

Since Euro-American settlement, conversion of prairie for agriculture is the most significant factor in the decline of American grasslands, and, thus, that of the rattlesnake-master borer moth. According to Samson and Knoff (1994, p. 419), by 1994, tallgrass prairie had declined 99.9 percent from historical levels in Illinois, Iowa, and Indiana and 99.5 percent in Missouri. Warner (1994) studied the transition of land use in Illinois since 1800. He found that between 1820 and 1920, Illinois went from almost two-thirds of the State covered with prairie to less than 1 percent (Warner 1994, p. 149). With the onset of intensive row-cropping after the 1950s, Illinois saw declines in diversified farming practices that included grazing of livestock on grasslands, leading to even further losses of grasslands (Warner 1994, p. 150). The loss of grasslands has been precipitous

and has followed the settlement of the Midwest and the expansion and modernization of farming practices. The current threat of such conversion to extant populations is not well known and may now be secondary to other threats.

### *Nonagricultural Conversion of Prairie*

The conversion of remaining prairie remnants for nonagricultural purposes continues to be a threat for some of the rattlesnake-master borer moth sites. Both Arkansas sites are within military installations and are under pressure of potential changes in land-use based on base priorities. An incinerator was constructed on top of one site containing rattlesnake-master borer moth within the Pine Bluff Arsenal (Zollner 2013, pers. comm.). Air Force officials are considering allowing development in one area of the Little Rock Air Force Base that contains populations of rattlesnake-master (Popham 2013, pers. comm.). Although researchers did not find rattlesnake-master borer moths within this savanna area in 1997, removal of this area would decrease the opportunity of the moth to expand into other habitat.

In Illinois, several of the populations are close to Chicago and are within urban areas; however, all of those that are not railroad sidings are managed to maintain the prairie habitat and are currently protected from development. A high-speed rail project planned from Chicago, Illinois, to St. Louis, Missouri, may impact rattlesnake-master borer populations located within railroad sidings. According to the U.S. Department of Transportation (USDOT) Environmental Impact Statement (EIS) (2012, pp. 5–34), all proposed alternatives would impact approximately 94 hectares (233 acres) of prairie remnants. The populations of rattlesnake-master borer moth occurring within the railroad

sidings in Will, Livingston, and Grundy Counties are located along the same Union Pacific railroad track that has been identified in all of the build alternatives in the USDOT EIS (USDOT EIS 2012, Appendix A).

Although not all of the project plans have been finalized, potential construction impacts to the railroad siding prairies included in the EIS include construction of a second rail in order to provide double tracking for the entire alignment and construction of a parallel maintenance road along the alignment, both of which could impact populations of rattlesnake-master borer moth (USDOT EIS 2012, pp. 3–19). Surveys will be conducted in the coming years to identify all rattlesnake-master borer moth populations in these areas and potentially translocate individuals out of the construction zone (LaGessee 2013, pers. comm.). There are some indications that construction of the second track may impact the entire west side of the current alignment, effectively removing half of the prairie habitat in some places (LaGessee 2013, pers. comm.).

### *Fire*

Rattlesnake-master borer moth populations existed historically in a vast ecosystem maintained in part by fire. Although prairie insects are adapted to fire in some ways, experts suggest that prescribed burns that are conducted frequently and cover entire insect populations can be detrimental (Schweitzer *et al.* 2011, p. 42). The rattlesnake-master borer moth is restricted in population size and distribution and thus is sensitive to management activities that are implemented across an entire site, such as fire (Panzer 2002, p. 1298). In his 2002 study, Panzer (2002, pp. 1296–1306) examined the recovery rate of fire-sensitive insects by assessing their post-fire response. Panzer (2002, p. 1306)

identified four life history traits of duff-dwelling insects such as rattlesnake-master borer moth that were good predictors of a negative response to fire: (1) Remnant dependence (occurring as small, isolated populations); (2) upland inhabitation (dry uplands burn more thoroughly than wetter habitats); (3) nonvagility (low recolonization rate); and (4) univoltine (slower recovery rates for species with only one generation per year). He said that species exhibiting one or more traits should be considered fire-sensitive and species with all four traits should be considered “hypersensitive” to fire (Panzer 2002, p. 1306). The rattlesnake-master borer moth exhibits all four of these traits and thus, according to Panzer (2002, p. 1306), is hypersensitive to fire.

He indicated that univoltine, duff-inhabiting species like *Papaipema* moths should be considered especially susceptible to extirpation from fire (Panzer 2002, p. 1298). Adult rattlesnake-master borer moths are not known to disperse widely and are thought to be relatively sedentary making adults more vulnerable to fire (Panzer 2003, p. 18; LaGesse et. al 2009, p. 4). They lay their eggs close to the host plant where they overwinter in the duff making the eggs and first instars susceptible to burns conducted from late fall to late spring before larvae have a chance to bore into the root of the plant (Derkovitz 2013, pers. comm.; LaGesse *et al.* 2009, p. 4; Bird 1917, p. 126). They are more resistant to the effect of fire during summer months after they have bored into the root and are below ground.

Rattlesnake-master borer moths were one of the species included in Panzer’s (2003, p. 18) study of the importance of in situ survival, recolonization, and habitat gaps in the post-fire recovery of fire-sensitive prairie insects. Panzer studied the in situ survivorship of rattlesnake-master borer moths after burning 100 percent of the available

habitat for some small populations that were at least 200 m (656 ft) from potential recolonization sources (2003, p. 18). Larval surveys were conducted to detect the presence of rattlesnake-master borer moths in order to eliminate the potential of detecting adults that may be recolonizing from other areas. Larvae were found in one out of two of the smallest populations burned that were between 4 m<sup>2</sup> and less than 8 m<sup>2</sup> (43 and 86 ft<sup>2</sup>) (Panzer 2003, p. 19). Panzer (2003, p. 19) found better survivorship on larger patches burned, with individuals surviving in all of the populations that were between 8 m<sup>2</sup> and less than 16 m<sup>2</sup> (86 and 172 ft<sup>2</sup>), and between 16 m<sup>2</sup> and less than 32 m<sup>2</sup> (172 and 344 ft<sup>2</sup>) (two out of two for each). A prescribed burn conducted in 1994 affected the entire population of rattlesnake-master borer moth at the North Carolina site (Hall 2012, pers. comm., Schweitzer *et al.* 2011, p. 351). The subsequent 1995 survey resulted in location of one larva, and the only other survey of the site (conducted in 2002) resulted in the detection of one potential bore hole (Hall 2012, pers. comm.). The presence of individual rattlesnake-master borer moths in areas that are completely burned indicates that in situ survival likely does contribute to the recovery of a population after a burn (Panzer 2003, p. 20); however, it is unknown if they can sustain themselves with repeated burns without recolonization.

The effects of fire on individual rattlesnake-master borer moth populations are difficult to ascertain as populations differ in size, density, and type of habitat they occupy. Also, some populations may be under stress from other threats making the effects of fire more detrimental (Panzer 1988, p. 87). The fire sensitivity of rattlesnake-master borer moth indicates that fire is a threat in habitats burned too frequently or too broadly. In order to reap the benefits of fire to habitat quality, rattlesnake-master borer

moths must either survive in numbers sufficient to rebuild populations after the fire or recolonize the area from a nearby unburned area (Schweitzer *et al.* 2011, p. 251; Panzer 2003, p. 19; Panzer 1988, p. 88). In addition, the return interval of fires needs to be infrequent enough to allow for recovery of the populations between burns. Panzer indicates that burn programs that do not provide sanctuaries for fire-sensitive species, especially on small sites, will contribute to their loss across the landscape (Panzer 2003, p. 20). Prescribed burns that are designed to leave some patches of unburned habitat (by burning when it is wet or cool) may provide additional in situ survival, which may be important for fire-sensitive species on small sites (Panzer 2003, p. 20).

Complete fire suppression, however, can lead to the decline of prairie habitat, as well as savanna and pine barrens, as woody species become established (Schweitzer *et al.* 2011, p. 40; Panzer and Schwartz 2000, p. 363). The natural fire processes that once maintained prairie habitat have been altered by the modern landscape and without the addition of burning of these small patches of prairie habitat, they are subject to succession and the buildup of plant litter (Swengel 1998, p. 77). Although found commonly in undisturbed remnant prairies, rattlesnake-master is a highly conservative species and has been found to have relative frequencies in restored and relict prairies of less than 1 percent (Danderson and Molano-Flores 2010, p. 235; Molano-Flores 2001, p. 1). Given its dependence on its host plant, proper fire management relative to the needs of its host plant and to retain prairie habitat is very important for rattlesnake-master borer moths.

Of the 16 known rattlesnake-master borer moth sites, 10 are or have been managed with fire. The prairie community on the entire Tallgrass Prairie Preserve in

Oklahoma is managed with a randomized prescribed fire regime that includes grazing designed to mimic the natural forces found on site prior to settlement (Hamilton 2013, pers. comm.). In Illinois, six sites are protected (four in State ownership, one owned by Northeastern Illinois University, and one private but managed as a natural area) and managed with prescribed fire, and all have extant populations that are considered stable. These sites are comparatively large and range from 1,700 acres (688 hectares) to the smallest at 40 acres (16 hectares), and all contain scattered populations of rattlesnake-master borer moths within the sites (Derkovitz 2013, pers. comm.; LaGesse 2013, pers. comm.).

The savanna remnants within the Pine Bluff Arsenal in Arkansas where rattlesnake-master borer moth are found are also managed with fire (Zollner 2013, pers. comm.). This area is managed yearly with rotational prescribed burning usually before April 15 (Zollner 2013, pers. comm.). Annual surveys at the Pine Bluff Arsenal indicate that the population has stayed stable, with generally the same number of larvae found, but always fewer than 20 individuals (Zollner 2013, pers. comm.). The use of prescribed fire in the relatively large prairie remnants described above appears to be maintaining the prairie ecosystem at the sites without impacting the overall population of rattlesnake-master borer moths. The pine barrens site in North Carolina is comparably smaller and is all located within one burn unit (Hall 2013, pers. comm.). The entire area was burned in 1994, which may have impacted the rattlesnake-master borer moth population as only one larva was found during the subsequent survey in 1995, and evidence of only one borer hole was found in 2001 (Hall 2012, pers. comm.; Schweitzer *et al.* 2011, p. 351). Surveys were also conducted within a railroad prairie on the Pine Bluff Arsenal which

contains many rattlesnake-master plants, but the moth has never been found there, either during the 1997 survey or subsequent surveys, and researchers suggested that the fire regime in this area may be suppressing the colonization of this area by the moth (Zollner 2013, pers. comm.; Weaver and Boos 1998, pp. 16–17).

At this time, it does not appear that fire prescriptions for any of the rattlesnake-master borer moth sites are designed to avoid burning while any of the life stages (adult, egg, larva) are located within the prairie duff layer or are designed so that only portions of the rattlesnake-master borer moth populations or its host plant are burned at one time. Research has shown that even when entire sites are burned, rattlesnake-master borer moths can survive in situ; however, given their sensitivity to fire it is likely that populations rely on recolonization from unburned sanctuaries. It is possible that not all of the populations on the larger sites are being burned at once, given that populations of rattlesnake-master borer moth are not found in single populations, but are scattered within the sites. Fire is a current and ongoing rangewide threat of high severity. Where burns occur, the moths need a sufficient amount of contiguous or nearby habitat from which immigrants can reinhabit burned areas.

### *Grazing*

The productivity of prairie decreases as excess plant litter accumulates (Robertson *et al.* 1997, p. 57). Grazing and fire were two natural disturbance factors that historically maintained the prairie ecosystem by removing some of this biomass (Robertson *et al.* 1997, p. 56). Approximately 60 million plains bison (*Bison bison*) once grazed throughout the Midwest prairie (Samson and Knopf 1994, p. 419). Wallowing by bison

and trampling by bison and cattle creates open areas that can increase species richness and heterogeneity in prairie (Robertson *et al.* 1997, p. 58). Grazing is used as a management tool in two of the rattlesnake-master borer moth sites; the Tallgrass Prairie Preserve in Oklahoma and an IDNR owned property in Illinois.

Both cattle and bison graze within the Tallgrass Prairie preserve, separated into two different units with different management regimes (Hamilton 2007, pp. 163–168). The 2,700 bison graze freely throughout the entire 23,500 acres (9,510 hectares) of the bison tract (Hamilton 2013, pers. comm.). The prescribed fire regime within the bison unit is randomized, and managers of the Preserve have found that bison generally graze in newly burned areas during the growing season in order to take advantage of the increased forage quality of the new regrowth (Hamilton 2007, p. 168). Researchers have found that, before the introduction of the bison, the rattlesnake-master on the Preserve was located in small populations (LaGesse 2013, pers. comm.) The rattlesnake-master has spread since the introduction of the bison, likely because the seeds of the plant have evolved small hooks that stick in the fur of the bison and are distributed as they range through the Preserve (LaGesse 2013, pers. comm.; LaGesse *et al.* 2009, p. 3).

The cattle unit is approximately 526 hectares (13,000 acres) and is managed with experimental treatments including “patch burn” treatments initiated under research by Oklahoma State University in 2001 (Hamilton 2007, p. 168). It is not known whether there are populations of rattlesnake-master borer moth or its host plant in the cattle unit of the Preserve. Cattle are used as grazing management on one of the Illinois DNR properties in order to create structure for grassland birds (LaGesse 2013, pers. comm.). Cattle are allowed into the property for approximately 60 days a year to “flash graze” the

area (LaGesse 2013, pers. comm.). In their 2008 survey of this area, LaGesse and Wiker (2008, p. 8) found that cattle had consumed most of the flowering rattlesnake-master, but found no negative impacts to the rattlesnake-master borer moths. The researchers note that when cattle were introduced on a neighboring tract after the rattlesnake-master flowers had hardened, they were not eaten (LaGesse and Wiker 2008, p. 8). They suggest that introduction of cattle to a population of rattlesnake-master after the flowers have hardened may protect them from being grazed and avoid a decrease in seed production (LaGesse and Wiker 2008, p. 8). In both of these examples, bison and cattle herds are managed so that there is no overgrazing.

#### *Lack of Management, Succession, Invasive Species*

While inappropriate or excessive burning are threats to rattlesnake-master borer populations, the species is also under threat where there is no management to maintain prairie habitats. Without periodic disturbance, prairies are subject to expansion of woody plant species (secondary succession), litter accumulation, or invasion by nonnative plant species (*e.g.*, smooth brome) (McCabe 1981, p. 191; Dana 1997, p. 5; Higgins *et al.* 2000, p. 21; Skadsen 2003, p. 52). Panzer and Schwartz (2000, p. 367) found a higher density of rattlesnake-master borer moths within fire-managed populations than fire-excluded populations in Illinois. Several sites with rattlesnake-master borer moths are not managed—invasive species and woody encroachment are threats to populations at those sites (Derkovitz 2013, pers. comm.; Lauder milk 2012, pers. comm.). The railroad siding prairies in Will, Grundy, and Livingston Counties, Illinois, are all unmanaged and are under threat of invasion by woody plant species, like buckthorn (*Rhamnus* spp.)

(Derkovitz 2013, pers. comm.). The succession to woody plants changed the composition of the plant community on one Kentucky site, resulting in the likely extirpation of rattlesnake-master borer moths (Laudermilk 2012, pers. comm.). Lack of management is considered to be a threat where the rattlesnake-master borer moth habitat is degraded or likely to become degraded due to secondary succession, invasive species, or both. This is likely the case at all six of the sites where there is not ongoing management of the prairie.

### *Flooding*

Flooding is a threat to at least two rattlesnake-master borer moth populations. Although evidence of boring was found in rattlesnake-master in Fayette County, Illinois in 2009, the areas were subsequently flooded due to heavy rain events (LaGessee and Walk 2010, unpaginated). These populations were reconfirmed in 2010; however, researchers believe this area will likely continue to be affected by flooding in years of heavy rain (LaGessee 2013, pers. comm.; LaGessee and Walk 2010, unpaginated). The two Illinois DNR sites in Will and Grundy Counties have been documented with standing water in wet springs, which may affect the rattlesnake-master borer moth populations, depending on the duration and extent of the flooding (Derkovitz 2013, pers. comm.).

### *Herbicide Application*

In 2009, an application of herbicide affected populations of rattlesnake-master in the railroad siding prairie in Marion, Effingham, and Fayette Counties (LaGessee and Walk 2010, unpaginated). LaGessee and Walk (2010, unpaginated) found that 2

rattlesnake-master populations were completely destroyed and 19 declined between 2009 and 2010. After comparing the data from 2009 and 2010, researchers found that both the overall population of rattlesnake-master and the density of the plants decline (LaGesse and Walk 2010, unpaginated). The impact to the food plant also affected the rattlesnake-master borer moths. Fourteen populations of rattlesnake-master borer moths with a total of 112 caterpillars were detected in 2010 with one-third of the 9 populations of rattlesnake-master borer moths surveyed declining from 2009 to 2010 (LaGesse and Walk 2010, unpaginated).

*Conservation Efforts To Reduce Habitat Destruction, Modification, or Curtailment of Its Range*

Seven of the 16 rattlesnake-master borer moth sites are currently owned and managed by State conservation agencies, a university, or management entity that protects them from development. All of these sites have some sort of management regime that is being implemented to maintain the prairie community that allows the subsistence of the species' food plant and protects the site from encroachment of woody habitat. Six of the seven sites are maintained with fire, and the seventh is maintained with fire and grazing. None of the management regimes are specifically designed to avoid direct impacts to the species, although the largest sites (five in Illinois and one in Oklahoma) have extant populations that appear to be stable.

*Summary of Factor A*

We have identified a number of threats to the habitat of the rattlesnake-master borer moth that operated in the past, are impacting the species now, and will continue to impact the species in the future. The decline of the rattlesnake-master borer moth is the result of the long-lasting effects of habitat loss, fragmentation, degradation, and modification from agriculture, development, flooding, invasive species, and secondary succession. Although efforts have been made to effectively manage habitat in some areas, the long-term effects of large-scale and wide-ranging habitat modification, destruction, and curtailment will last into the future. Development of a high-speed rail project in Illinois will likely impact three known populations of rattlesnake-master in three counties, and development on the two military installations in Arkansas has destroyed one population of the species and may impact the other. Fire and grazing cause direct mortality of the moth or destroy food plants if the intensity, extent, or timing is not conducive to the species' biology. The application of herbicides affected several populations of rattlesnake-master and caused direct mortality to resident rattlesnake-master borer moths, causing a decline in some of the populations the following summer.

Of the 16 sites considered to be occupied by the rattlesnake-master borer, all of the sites have at least one documented threat. Some sites have more than one threat, and concurrently acting threats may have more intense effects than any one threat acting independently. Almost all of the sites with extant populations of rattlesnake-master borer moth are isolated from one another, with populations in Kentucky, North Carolina, and Oklahoma occurring within a single site for each State, preventing recolonization from other populations. Of the sites that are currently protected from development and are under management to maintain the prairie ecosystem, all of them utilize management

regimes (either burning or grazing or both) that could potentially impact individual rattlesnake-master borer moths and whole populations depending on the timing, extent, and frequency of the events. Two of these sites are also known to have standing water during large rain events in the spring which may impact rattlesnake-master borer moths.

*Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes*

Illegal collection of rattlesnake-master borer moths has been noted at two IDNR managed sites in Illinois close to Chicago (Derkovitz 2012, pers. comm.; Illinois Natural Heritage Database 2012). The locations of these populations are not publicized. Although there have been no known poaching events within the Kentucky sites, managers are concerned and indicate that this species is sought after by lepidopterists in that State and keep the location of that site undisclosed (Laudermilk 2012, pers. comm.). Adult rattlesnake-master borer moths have been noted as hard to collect (see life history section); however, the host plant is easy to identify, which could make locating the larvae easier and the species more susceptible to collection (Schwietzer 2011, p. 45).

Some extant populations of rattlesnake-master borer moths are known to be very small and made up of very few individuals. Because the host plant is easily identifiable, it is conceivable that an entire population could be impacted by one collector if enough host plants are removed. Collection from the remaining small and isolated populations could have deleterious effects on this species' reproductive and genetic viability. Due to the species' small population size, limited range, and the potential ease of collection of

larval individuals, recreational collecting of this species presents a threat now and in the future throughout its range.

*Conservation Efforts To Reduce Overutilization for Commercial, Recreational, Scientific, or Educational Purposes*

As discussed in *Factor D: The Inadequacy of Existing Regulatory Mechanisms*, the rattlesnake-master borer moths is listed as endangered on Illinois' State threatened and endangered species list, and Scientific Collectors Permits are required in order to collect the species throughout the State, providing protection for the populations within the 10 Illinois sites. However, two of these Illinois sites are known to have had illegal collections. Seven of the rattlesnake-master borer moth populations, in North Carolina, Illinois, and Oklahoma, are within protected areas, and permission is required to collect specimens within all of these sites. The species is not specifically protected through State laws in Kentucky, Arkansas, Oklahoma, or North Carolina, and we know of no proposals to add this requirement in the future, leaving the two sites in Kentucky, and the two sites in Arkansas unprotected.

*Factor C. Disease or Predation*

There are no known diseases that are specific to rattlesnake-master borer moths, however, there is some evidence of parasitism in the moth, and known parasitism of the host plant, rattlesnake-master. While parasitism has been found by researchers in rattlesnake-master borer moth larvae, the species of parasite is unknown (LaGessee 2013, pers. comm.). Eggs and larvae of parasitic species have been found using rattlesnake-

master borer moth caterpillars as hosts, although at this time there is no conclusive evidence of potential effects to the species or populations as a whole.

Second and third instar rattlesnake-master borer moths have also been known to cannibalize each other. During the time that the larvae are actively boring into the host plant, researchers have detected cannibalistic behavior with some caterpillars moving into already occupied bore holes, killing the occupant, and pushing them back out (LaGesse *et al.* 2009, p. 4).

The caterpillars of another species of moth, *Coeotechnites eryngiella*, are known to bore into the seeds of rattlesnake-master, sometimes affecting up to 60–70 percent of rattlesnake-master seeds (Danderson and Molano-Flores 2010, p. 235; LaGesse *et al.* 2009, p. 3; Molano-Flores 2001, p. 5). Danderson and Molano-Flores (2010, p. 242) found that the herbivory of rattlesnake-master by *C. eryngiella* causes a change in physical appearance of the inflorescence and resulted in a decrease in flower visitation by pollinators.

### *Summary of Factor C*

Available information indicates disease is not a threat to the rattlesnake-master borer moth. There is evidence that parasitism and predation occur, however, the impacts to this species and its host plant rattlesnake-master are unclear. Researchers have found that the parasitism of rattlesnake-master by rattlesnake-master borer moths and *C. eryngiella* can affect individual plants and potentially whole populations. Some extant populations of rattlesnake-master borer moths are known to be very small, made up of very few individuals. It is possible that parasitism of the species by wasps and potentially

the cannibalism by individuals competing for host plants may impact small populations of rattlesnake-master borer moths, especially those that are also under stress from other threats. Available information indicates that disease, parasitism, and predation are not threats that have substantial impacts to rattlesnake-master borer moth individuals or populations.

*Factor D. The Inadequacy of Existing Regulatory Mechanisms*

The rattlesnake-master borer moth is listed as endangered by two States in which it is found, Illinois and Kentucky. In Illinois, the moth is listed as endangered under the Illinois Endangered Species Protection Act, which “prohibits the possession, taking, transportation, sale, offer for sale, or disposal of any listed animal or products of listed animals without a permit issued by the Department of Conservation” (Illinois Endangered Species Protection Board 2011, p. 7). The Illinois Endangered Species Protection Board is responsible for determining which species are listed in the State and for advising the Illinois DNR on methods of protection and management of listed species (Illinois DNR website 2013, <http://www.dnr.illinois.gov/espb/Pages/default.aspx>). The Illinois DNR office of Realty and Environmental Planning administers the State’s threatened and endangered species consultation program and works with agencies, developers, and other project proponents to assess the potential effects of projects and potentially mitigate them (Illinois DNR website 2013, <http://www.dnr.illinois.gov/espb/Pages/default.aspx>). For development or agency projects that are determined to affect listed species, an incidental take permit is required (Illinois DNR website 2013,

<http://www.dnr.illinois.gov/ESPB/Pages/EndangeredSpeciesPermitsandIncidentalTake.aspx>).

Project proponents for the proposed High Speed Rail project from Chicago, Illinois, to St. Louis, Missouri, are currently working through the State's consultation process, including requesting an incidental take permit for potential effects to rattlesnake-master borer moths in the alignment (LaGesse 2013, pers. comm.). For researchers, a collection permit is required for the possession of specimens or products of Illinois that are listed as threatened or endangered, and additional permits are required for collection of any species within the State's parks, forests, and conservation areas, or Illinois Nature Preserves or registered Illinois Land and Water Reserves (IDNR website 2013, <http://www.dnr.illinois.gov/ESPB/Pages/EndangeredSpeciesPermitsandIncidentalTake.aspx>).

The rattlesnake-master borer moth is also listed as endangered in Kentucky by the State's Nature Preserves Commission (Kentucky State Nature Preserves Commission 2013, p. 35). At this time Kentucky legislature has not enacted any statute that provides legal protection for species listed as threatened or endangered (Laudermilk 2013, pers. comm.).

The rattlesnake-master borer moth is not protected in Arkansas as it has not been named to the State list of threatened or endangered species and is not named in the State's Wildlife Action Plan as a Species of Greatest Conservation Need (Arkansas Game and Fish Commission website 2013, <http://www.agfc.com/species/Pages/SpeciesEndangered.aspx>; Anderson 2006, p. 2028). It is also not protected under State threatened and endangered species statutes in

Oklahoma and North Carolina (Oklahoma Department of Wildlife Conservation website 2013, <http://wildlifedepartment.com/wildlifemgmt/endangeredspecies.htm>; North Carolina Wildlife Resources Commission 2008, p. 8). However, the sites within these States are owned and managed by the State (in North Carolina) and The Nature Conservancy (in Oklahoma) and require a collection permit within these two sites (Hall 2013, pers. comm.; Hamilton 2013, pers. comm.).

The U.S. Forest Service has designated the rattlesnake-master borer moth as a sensitive species in Region 9, which includes the State of Illinois (U.S. Forest Service 2003, p. 4). At this time there are no known populations of the species within the Forest Service's lands, so the designation of sensitive species status for this species will have no benefit at this time. However, it may be beneficial if populations are identified on Forest Service lands in the future.

To summarize, existing regulatory mechanisms, including State endangered species statutes, provide protection for 12 of the 16 sites containing rattlesnake-master borer moth populations. Illinois provides regulatory mechanisms to protect the species from potential impacts from actions such as development and collecting; however, illegal collections of the species have occurred at two sites. A permit is required for collection by site managers within the sites in North Carolina and Oklahoma, although no statutory mechanisms protect the populations in North Carolina, Kentucky, Arkansas, or Oklahoma, which leaves privately owned sites in Arkansas and Kentucky unprotected from collection.

*Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence*

### *Habitat Fragmentation and Population Isolation*

Rattlesnake-master borer moths are habitat specialists, which has a strong negative effect on their distribution and abundance. The species is completely dependent on prairie habitat and, more specifically, on a single larval food plant species, rattlesnake-master. Habitat fragmentation has reduced the once extensive prairie habitat to a collection of isolated patches of varying quality. Most prairie remnants that remain have been or continue to be subjected to haying, grazing, dumping, fire suppression, or succession, all of which degrade prairie quality (Panzer 1988, p. 83).

Prairie remnant-dependent species, such as rattlesnake-master borer moths, are more susceptible to extinction from stochastic events than other insects, due to their fluctuating population densities, poor dispersal abilities, and patchy distribution (Panzer 1988, p. 83). The potential for extirpation within patches is intensified by the addition of other threats such as development, fire, grazing, and succession. Rattlesnake-master borer moths are not known to disperse widely and have been described as “relatively sedentary” (Panzer 2003, p. 18; LaGesse *et al.* 2009, p. 4). Researchers believe that the species will remain within a habitat patch unless the amount of rattlesnake-master becomes limiting and the moths are forced to seek out additional food plants (LaGesse 2013, pers. comm.). The moths also have relatively short flight times of approximately 2 weeks and may only fly during the pheromone “calling” times of the female, which may be only a couple of hours a night (Wiker 2013, pers. comm.). Rattlesnake-master borer moths within the Tallgrass Prairie Preserve in Oklahoma may have recolonized to habitat that was 2 miles (3.2 km) from their original patch of rattlesnake-master when the food

plant became scarce (LaGesse 2013, pers. comm.). Recolonization like this is likely not possible for many of the remaining populations of the species as they are isolated from one another, most are surrounded by agricultural fields or urban areas with no connecting habitat, and most are separated by distances greater than 2 miles (3.2 km). Species that are widely distributed in small populations are more susceptible to catastrophic events, and extirpations at individual sites will be permanent if there are no populations close enough that can recolonize the area.

Railroad siding prairies may afford the species the most likely opportunity for migration between populations or into new patches of rattlesnake-master, as they contain the most contiguous habitat, sometimes spanning many miles. The large railroad prairie in Marion, Fayette, and Effingham Counties contains long stretches of connected habitat, with the entire prairie corridor stretching for 22 miles (35 km) (LaGesse *et al.* 2009, p. 6). Although populations of the food plant are described as patchy within the prairie habitat, this linear area affords the species the opportunity to disperse without having to traverse urban or agricultural environments. The railroad siding prairies in Will, Grundy, and Livingston Counties occur along the same corridor, but the remnant prairie here is patchy and populations are described as being very small (Derkovitz 2013, pers. comm.; Illinois Natural Heritage Database, 2012). Although the railroad prairies may afford the species the most likely opportunity for migration between populations, these sites are not protected, are subject to development and other disturbance, and receive minimal or no management to maintain the prairie habitat. Also, small populations of rattlesnake-master borer moths may not be able to maintain large enough population sizes when they

are under pressure from other threats to be able to produce enough adults to immigrate to new areas.

Even with proper prairie management, extreme weather patterns or severe weather events have the potential to significantly impact rattlesnake-master borer moth populations, because they can occur across a large geographic area. These events include extremely harsh winters, late hard frosts following a spring thaw, severe storms, flooding, fire, or cool damp conditions. Habitats isolated as a result of fragmentation will not be recolonized naturally after local extirpations, as described above, and extirpation of individual populations from catastrophic events is more likely when they are isolated and widely spread.

Isolated populations like those of the rattlesnake-master borer moth likely do not receive any immigration of individuals from other populations. Without sufficient gene flow, populations in small, fragmented habitats are unlikely to remain viable over the long term (Frankham *et al.* 2009, p. 309). There have been no genetic studies of the rattlesnake-master borer moth to date; however, populations within fragmented habitats, like the rattlesnake-master borer moth, are predicted to have lower genetic diversity than those that occur in contiguous habitat, due to restricted gene flow, genetic drift, and increased inbreeding (Frankham *et al.* 2009, pp. 334–335). Reduced fitness (reduced genetic diversity) results in a reduced ability to adapt to environmental change (Frankham *et al.* 2009, p. 523).

Twelve of the known sites containing rattlesnake-master borer moth are considered isolated, as they are not connected by contiguous habitat to other prairie containing rattlesnake-master and are not likely to be recolonized by the low dispersing

adult rattlesnake-master borer moths. The Tallgrass Prairie Preserve in Oklahoma represents the largest area of contiguous prairie habitat in which the rattlesnake-master borer moth exists, but there are no other known populations in Oklahoma. Due to the few numbers and small size of remaining populations, and their degree of isolation, habitat fragmentation and isolation is a threat that has significant impacts to the rattlesnake-master borer moth across its range.

### *Climate Change*

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms “climate” and “climate change” are defined by the Intergovernmental Panel on Climate Change (IPCC). “Climate” refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007, p. 78). The term “climate change” thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

As is the case with all stressors that we assess, even if we conclude that a species is currently affected or is likely to be affected in a negative way by one or more climate-related impacts, it does not necessarily follow that the species meets the definition of an “endangered species” or a “threatened species” under the Act. If a species is listed as endangered or threatened, knowledge regarding the vulnerability of the species to, and known or anticipated impacts from, climate-associated changes in environmental conditions can be used to help devise appropriate strategies for its recovery.

Global climate change, with projections of increased variability in weather patterns and greater frequency of severe weather events, as well as warmer average temperatures, would affect remnant prairie habitats and may be a significant threat to prairie species such as the rattlesnake-master borer moth (Royer and Marrone 1992b, p. 12, 1992a, pp. 22–23, Swengel *et al.* 2011, p. 336, Landis *et al.* 2012, p. 140). Rattlesnake-master borer moth habitat may experience the effects of gradual shifts in plant communities and an increase in catastrophic events (such as severe storms, flooding, and fire) due to climate change, which is exacerbated by habitat fragmentation. The isolation of rattlesnake-master borer moth populations makes them unlikely to recover from local catastrophes without artificial reintroduction or propagation, because they are not close enough to other populations for recolonization to occur.

Documentation of climate-related changes that have already occurred throughout the range of the rattlesnake-master borer moth (*e.g.*, Johnson *et al.* 2005, pp. 863–871) and predictions of changes in annual temperature and precipitation in the Midwest region of the United States (Galatowitsch *et al.* 2009, p. 2017), and throughout North America (IPCC 2007, p. 9) indicate that increased severity and frequency of droughts, floods,

fires, and other climate-related changes will continue in the future. Recent studies have linked climate change to observed or predicted changes in distribution or population size of insects, particularly Lepidoptera (Wilson and Maclean 2011, p. 262). Climate change is an emerging threat and has the potential to have severe impacts on the species; however, at this time our knowledge of how these impacts may play out is limited. All of the sites within the range of the species are in an area that could experience the effects of climate change.

### *Prairie Management Techniques*

Native prairie must be managed to prevent the indirect effects of invasive species and succession from affecting rattlesnake-master borer moth populations. If succession has progressed too far, established shrubs or trees must be removed in a way that avoids or minimizes damage to the native prairie. When succession is well advanced, managers must use intensive methods, including intensive fire management, to restore prairie plant communities. If not administered carefully prescriptive methods such as fire and grazing themselves can harm local populations of rattlesnake-master borer moths (for example, see *Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range*). Rattlesnake-master borer moths are susceptible to the effects of prairie management techniques much of the year because the eggs overwinter in the prairie duff, and early instars are located on the leaves and stems of the food plant and do not bore beneath the surface of the soil into the root ball until late June (LaGesse *et al.* 2009, p. 4). The above life history traits and the adults' low dispersal ability make them susceptible to mortality from prescribed fires, except when they have bored into the root

of the host plant. Eggs and first instar caterpillars are also more susceptible to the effects of grazing cattle and bison before they bore into the root of the rattlesnake-master below the soil surface.

If not appropriately managed with fire, grazing, or haying, rattlesnake-master borer moth habitat is degraded due to reduced diversity of native prairie plants and eventually succeeds to shrubby or forested habitats that are not suitable for rattlesnake-master. Rattlesnake-master borer moth has been extirpated from one site in Kentucky, likely due to the succession to woody plants, which changed the composition of the plant community on site making it no longer suitable for the moth (Laudermilk 2012, pers. comm.).

Indiscriminate use of insecticides and herbicides to control invasive species and agricultural pests is also a threat to the species. In 2009, an application of herbicide affected populations of rattlesnake-master in the railroad siding prairie in Marion, Effingham, and Fayette Counties (LaGesse and Walk 2010, unpaginated). LaGesse and Walk (2010, unpaginated) found that 2 rattlesnake-master populations were completely destroyed and 19 declined between 2009 and 2010. The decline in the food plant impacted the rattlesnake-master borer moths populations, as three declined from 2009 to 2010 (LaGesse and Walk 2010, unpaginated).

In summary, efforts to manage invasive species and woody encroachment, such as fire, grazing, and herbicide use, is a threat to the rattlesnake-master borer moth. These management techniques, if not administered with the species in mind, can cause direct mortality and may impact whole populations. At least one management technique is being used or has been used on 10 of the 16 sites with known populations of rattlesnake-

master borer moths, and is occurring in all 5 States.

*Conservation Efforts To Reduce Other Natural or Manmade Factors Affecting Its Continued Existence*

The conservation activities discussed under *Factor A Habitat Destruction, Modification, or Curtailment of Its Range* may address some factors discussed under Factor E. Of the sites that are protected and managed (four Illinois DNR sites, one Northeast Illinois University site, the North Carolina site, and the Oklahoma Tallgrass Prairie Preserve site) all have some sort of management that is being implemented in order to maintain the prairie community in which the rattlesnake-master borer moth lives. However, those plans are not specifically designed to avoid direct impacts to the moth. We are unaware of any conservation efforts that would directly address the impacts from climate change to rattlesnake-master borer moths.

*Summary of Factor E*

Rattlesnake-master borer moths are significantly affected by habitat fragmentation and population isolation. Most of the remaining populations of the species are small and isolated, making them vulnerable to stochastic events and increasing the potential for extirpation from catastrophic events as natural recolonization from other populations is not possible. These small, isolated populations are likely to become unviable over time due to lower genetic diversity reducing their ability to adapt to environmental change (Frankham *et al.* 2009, pp. 309–335). Environmental effects resulting from climatic change, including increased flooding and drought, are expected to become severe in the

future and result in additional habitat losses. Although necessary for maintaining diverse prairie habitat and avoiding succession and invasive species, some prairie management techniques, such as fire and grazing, may cause mortality and impact rattlesnake-master borer moth populations if not administered carefully. Collectively, these threats have operated in the past, are impacting the species now, and will continue to impact the species in the future across its range.

*Cumulative Effects from Factors A through E.*

Many of the threats described in this finding may cumulatively or synergistically impact rattlesnake-master borer moth beyond the scope of each individual threat. For example, the use of prescribed fire may impact only some individual rattlesnake-master borer moths or small populations. However, populations that are small and potentially unviable, that are already under threat from succession or invasive species, coupled with an extensive drought, may collectively result in the extirpation of individual populations, and potentially the continued loss or fragmentation of habitat across all of the species' range. In turn, climate change may exacerbate those effects, further diminishing habitat and increasing the isolation of already declining and isolated populations, making them more susceptible to genetic drift or catastrophic events such as fire, flooding, and drought. Almost all of the 16 known rattlesnake-master borer moth populations are subject to two or more threats outlined in Factors A through E. One site is isolated and surrounded by urban landscape, has been subjected to illegal collecting, is managed with prescribed burning, and is known to have standing water during high rain events. Numerous threats are likely acting cumulatively and rangewide on the species.

## **Finding**

As required by the Act, we considered the five factors in assessing whether the rattlesnake-master borer moth is a threatened or endangered species throughout all of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by the rattlesnake-master borer moth. We reviewed the petition, information available in our files, and other available published and unpublished information, and we consulted with recognized rattlesnake-master borer moth experts and other Federal, State, and tribal agencies.

This status review identified threats to the rattlesnake-master borer moth attributable to Factors A, B, and E. The primary threat to the species is from habitat destruction and modification resulting in small, isolated populations that are subject to a greater risk of extirpation with little chance of recolonization (Factors A and E). The species has been found to be fire-sensitive and potentially affected by grazing activities, if they are conducted when life stages of the species are vulnerable, which is much of the year. Rattlesnake-master borer moths are dependent on one food plant, rattlesnake-master, which is a conservative prairie species and not generally found in disturbed habitats. Rattlesnake-master borer moths are currently not protected from collection or “take” in four of the five States in which it is found. Furthermore, poaching has been documented at two sites owned by the Illinois DNR, where it is listed as a State endangered species. Due to the historical habitat loss, current populations are small and isolated and thus are not resilient to ongoing threats.

On the basis of the best scientific and commercial information available, we find

that the petitioned action to list the rattlesnake-master borer moth as threatened or endangered is warranted. We will make a determination on the status of the species as an endangered or threatened species when we do a proposed listing determination.

However, as explained in more detail below, an immediate proposal of a regulation implementing this action is precluded by higher priority listing actions, and progress is being made to add or remove qualified species from the Lists of Endangered and Threatened Wildlife and Plants.

We reviewed the available information to determine if the existing and foreseeable threats render the species at risk of extinction now such that issuing an emergency regulation temporarily listing the species under section 4(b)(7) of the Act is warranted. We determined that issuing an emergency regulation temporarily listing the species is not warranted for this species at this time, because 5 of the 16 known populations have some sort of protections or management in place. However, if at any time we determine that issuing an emergency regulation temporarily listing the rattlesnake-master borer moth is warranted, we will initiate this action at that time.

### **Listing Priority Number**

The Service adopted guidelines on September 21, 1983 (48 FR 43098), to establish a rational system for using available resources for the highest priority species when adding species to the Lists of Endangered or Threatened Wildlife and Plants or reclassifying species listed as endangered or threatened species. These guidelines, titled “Endangered and Threatened Species Listing and Recovery Priority Guidelines” address

the immediacy and magnitude of threats, and the level of taxonomic distinctiveness by assigning priority in descending order to monotypic genera (genus with one species), full species, and subspecies (or equivalently, distinct population segments of vertebrates). We assigned the rattlesnake-master borer moth a Listing Priority Number (LPN) of 8 based on our finding that the species faces threats that are moderate to low in magnitude and are imminent. These threats include the destruction, modification, or curtailment of its habitat and range, overutilization for recreational or scientific purposes, habitat fragmentation and population isolation, and the direct mortality from some prairie management techniques. This is the highest priority that can be provided to a species under our guidance. Our rationale for assigning the rattlesnake-master borer moth an LPN of 8 is outlined below.

Under the Service's LPN Guidance, the magnitude of threat is the first criterion we look at when establishing a listing priority. The guidance indicates that species with the highest magnitude of threat are those species facing the greatest threats to their continued existence. These species receive the highest listing priority.

Some threats that the rattlesnake-master moth faces are high in magnitude, such as habitat conversion and fragmentation, and population isolation. These threats with the highest magnitude occur in many of the populations throughout the species' range, but although they are likely to affect each population at some time, they are not likely to affect all of the populations at any one time. Rattlesnake-master borer moths are habitat specialists, feeding solely on rattlesnake-master. Although rattlesnake-master is found in 26 States, the amount of tallgrass prairie in the United States has declined by approximately 82–99 percent (Samson and Knopf 1994, p. 418), and rattlesnake-master is

generally not found in disturbed prairie. Much of the remaining potential habitat that has not been converted for agricultural purposes or developed in other ways is made up of small remnant prairies that are widely scattered. These populations are isolated, making each one individually more likely to be extirpated if subjected to stochastic and catastrophic events. The small, isolated populations are also under threat of becoming unviable, as they receive limited or no immigration of individuals from other populations. Without sufficient gene flow, these populations will lose genetic diversity.

Other threats, such as agricultural and nonagricultural development, mortality from implementation of some prairie management tools, flooding, succession, and climate change are moderate to low threats because they affect only some populations throughout the range. The life history of rattlesnake-master borer moths makes them highly sensitive to fire. Although a useful tool in maintaining prairie habitat and fighting succession, prescribed burning has the potential to cause mortality of individuals through most of the year and can affect entire populations. Ten of the 16 sites with rattlesnake-master borer moths use fire as a management tool. Research has shown that even when entire sites are burned, rattlesnake-master borer moths can survive in situ. However, given their sensitivity to fire, populations likely rely on recolonization from unburned areas. It is possible that not all of the populations on the larger sites are being burned at once, because populations of rattlesnake-master borer moth are scattered within the sites. The population within the North Carolina site may have been impacted by this management tool as surveys conducted after the 1994 fire that affected the entire site showed evidence of only one individual larva (Hall 2012, pers. comm.). Conversely, complete fire suppression can also be a threat to rattlesnake-master borer moths as prairie

habitat declines and woody or invasive species become established (Schweitzer *et al.* 2011, p. 40; Panzer and Schwartz 2000, p. 363). The rattlesnake-master is a conservative plant species and not found in disturbed prairies (Danderson and Molano-Flores 2010, p. 235; Molano-Flores 2001, p. 1). The population of rattlesnake-master borer moth on one Kentucky site is thought to have been extirpated due to succession of the prairie to woody species (Laudermilk 2012, pers. comm.)

Although conversion of prairie to agricultural purposes has been precipitous, we have no indication that it is currently a threat of high magnitude. Flooding and the application of herbicide are additional threats to the species, although their incidence has been localized and so are not considered of high magnitude. Climate change is an emerging threat, although it is not currently known to be affecting any of the populations of rattlesnake-master borer moths.

Regulatory mechanisms provide protection for 12 of the 16 known sites that contain rattlesnake-master borer moths. Seven of these sites are owned and managed by State agencies, nongovernmental organizations, and a university, and all rattlesnake-master borer moths in Illinois are protected from collection through the State's threatened and endangered species statute. Although regulatory mechanisms are in place, several sites are currently under threat by development, and known illegal collections of the moth have occurred within two of the protected sites in Illinois. Although some threats to the rattlesnake master borer moth are high in magnitude, we consider most threats to the species to be of moderate to low magnitude.

Under our LPN Guidance, the second criterion we consider in assigning a listing priority is the immediacy of threats. This criterion is intended to ensure that the species

that face actual, identifiable threats are given priority over those for which threats are only possible or species that are intrinsically vulnerable but are not known to be presently facing such threats. Every known population of rattlesnake-master borer moth has at least one imminent threat, and some have several working in tandem. These actual, identifiable threats are covered in detail under the discussion of Factors A, B, and E of this finding and currently include conversion of habitat for nonagricultural use, fire, flooding, succession, overutilization, and habitat fragmentation and population isolation. One Arkansas population of the species was impacted by construction of an incinerator on the Pine Bluff Arsenal, and three known populations in Illinois are under threat from the development of a high-speed rail project. Fire is used as a management tool on 10 of the known populations, is not prescribed in a way to avoid direct mortality to the species, and is thought to have adversely impacted the North Carolina population when it was burned entirely (Hall 2012, pers. comm.).

For those sites with no management, succession is an ongoing threat. For example, experts believe that specific rattlesnake-master borer moths populations have been extirpated due to the change in habitat from the succession to woody species (Laudermilk 2012, pers. comm.). Illegal collection is known from two Illinois DNR sites, and these two populations and one in Kentucky are kept undisclosed for fear of additional collection. Twelve of the known sites containing rattlesnake-master borer moth are considered isolated, as they are not connected by contiguous habitat to other prairie containing rattlesnake-master and are not likely to be recolonized by the poorly dispersing adult rattlesnake-master borer moths. Thus, the continuing effects of habitat fragmentation and isolation are a threat to the rattlesnake-master borer moth across its

range. Although not all of the threats are found within each site that contains populations of rattlesnake-master borer moth, the collective threats are impacting all of the known sites, and we believe the impacts will continue to impact the remaining populations.

The third criterion in our LPN guidance is intended to devote resources to those species representing highly distinctive or isolated gene pools as reflected by taxonomy. The rattlesnake-master borer moth is a valid taxon at the species level, and, therefore, receives a higher priority than subspecies or Distinct Population Segments (DPSs), but a lower priority than species in a monotypic genus. The rattlesnake-master borer moth faces high magnitude, imminent threats, and is a valid taxon at the species level. Thus, in accordance with our LPN guidance, we have assigned the rattlesnake-master borer moth an LPN of 8.

We will continue to monitor the threats to the rattlesnake-master borer moth and the species' status on an annual basis and, should the magnitude or the imminence of the threats change, we will revisit our assessment of the LPN.

Work on a proposed listing determination for the rattlesnake-master borer moth is precluded by work on higher priority listing actions with absolute statutory, court-ordered, or court-approved deadlines and final listing determinations for those species that were proposed for listing with funds from Fiscal Year 2013. This work includes all the actions listed in the tables below under expeditious progress.

### ***Preclusion and Expeditious Progress***

To make a finding that a particular action is warranted-but-precluded, the Service must make two findings: (1) that the immediate proposal and timely promulgation of a

final regulation is precluded by pending listing proposals, and (2) that expeditious progress is being made to add qualified species to either of the lists and to remove species from the lists. 16 U.S.C. §1533(b)(3)(B)(iii).

### Preclusion

A listing proposal is precluded if the Service does not have sufficient resources available to complete the proposal, because there are competing demands for those resources, and the relative priority of those competing demands is higher. Thus, in any given fiscal year (FY), multiple factors dictate whether it will be possible to undertake work on a listing proposal regulation or whether promulgation of such a proposal is precluded by higher priority listing actions—(1) the amount of resources available for completing the listing function, (2) the estimated cost of completing the proposed listing, and (3) the Service’s workload and prioritization of the proposed listing in relation to other actions.

### Available Resources

The resources available for listing actions are determined through the annual Congressional appropriations process. In FY 1998 and for each fiscal year since then, Congress has placed a statutory cap on funds that may be expended for the Listing Program. This spending cap was designed to prevent the listing function from depleting funds needed for other functions under the ESA (for example, recovery functions, such as removing species from the Lists), or for other Service programs(see House Report 105-163, 105th Congress, 1st Session, July 1, 1997). The funds within the spending cap are

available to support work involving the following listing actions: Proposed and final listing rules; 90-day and 12-month findings on petitions to add species to the Lists or to change the status of a species from threatened to endangered; annual “resubmitted” petition findings on prior warranted-but-precluded petition findings as required under section 4(b)(3)(C)(i) of the ESA; critical habitat petition findings; proposed and final rules designating critical habitat; and litigation-related, administrative, and program-management functions (including preparing and allocating budgets, responding to Congressional and public inquiries, and conducting public outreach regarding listing and critical habitat).

We cannot spend more for the Listing Program than the amount of funds within the spending cap without violating the Anti-Deficiency Act (see 31 U.S.C. 1341(a)(1)(A)). In addition, since FY 2002, the Service's budget has included a critical habitat subcap to ensure that some funds are available for completing Listing Program actions other than critical habitat designations ("The critical habitat designation subcap will ensure that some funding is available to address other listing activities" (House Report No. 107-103, 107th Congress, 1st Session. June 19, 2001)). In FY 2002 and each year until FY 2006, the Service had to use virtually the entire critical habitat subcap to address court-mandated designations of critical habitat, and consequently none of the critical habitat subcap funds were available for other listing activities. In some FYs since 2006, we have been able to use some of the critical habitat subcap funds to fund proposed listing determinations for high-priority candidate species. In other FYs, while we were unable to use any of the critical habitat subcap funds to fund proposed listing

determinations, we did use some of this money to fund the critical habitat portion of some proposed listing determinations so that the proposed listing determination and proposed critical habitat designation could be combined into one rule, thereby being more efficient in our work. In FY 2013, based on the Service's workload, we were able to use some of the critical habitat subcap funds to fund proposed listing determinations.

For FY 2012 Congress also put in place two additional subcaps within the listing cap: one for listing actions for foreign species and one for petition findings. As with the critical habitat subcap, if the Service does not need to use all of the funds within the subcap, we are able to use the remaining funds for completing proposed or final listing determinations. In FY 2013, based on the Service's workload, we were able to use some of the funds within the foreign species subcap and the petitions subcap to fund proposed listing determinations.

We make our determinations of preclusion on a nationwide basis to ensure that the species most in need of listing will be addressed first and also because we allocate our listing budget on a nationwide basis. Through the listing cap, the three subcaps, and the amount of funds needed to complete court-mandated actions within those subcaps, Congress and the courts have in effect determined the amount of money available for other listing activities nationwide. Therefore, the funds in the listing cap—other than those within the subcaps needed to comply with court orders or court-approved settlement agreements requiring critical habitat actions for already-listed species, listing actions for foreign species, and petition findings—set the framework within which we make our determinations of preclusion and expeditious progress.

For FY 2013, on March 26, 2013, Congress passed a Full Year Continuing Appropriations Act (Pub. L. No.113-6) which provides funding through the end of the FY 2013. In particular, it included a spending cap of \$20,997,000 for the listing program. In addition, no more than \$1,498,000 could be used for listing actions for foreign species and no more than \$1,498,000 could be used to make 90-day or 12-month findings on petitions. The Service thus had \$13,453,000 available to work on proposed and final listing determinations for domestic species. In addition, if the Service had funding available within the critical habitat, foreign species, or petition subcaps after those workloads had been completed, it could use those funds to work on listing actions other than critical habitat designations or foreign species.

Costs of Listing Actions. The work involved in preparing various listing documents can be extensive, and may include, but is not limited to: Gathering and assessing the best scientific and commercial data available and conducting analyses used as the basis for our decisions; writing and publishing documents; and obtaining, reviewing, and evaluating public comments and peer review comments on proposed rules and incorporating relevant information into final rules. The number of listing actions that we can undertake in a given year also is influenced by the complexity of those listing actions; that is, more complex actions generally are more costly. The median cost for preparing and publishing a 90-day finding is \$39,276; for a 12-month finding, \$100,690; for a proposed rule with critical habitat, \$345,000; and for a final listing rule with critical habitat, \$305,000.

Prioritizing Listing Actions. The Service's Listing Program workload is broadly composed of four types of actions, which the Service prioritizes as follows: (1) Compliance with court orders and court-approved settlement agreements requiring that petition findings or listing or critical habitat determinations be completed by a specific date; (2) section 4 (of the Act) listing and critical habitat actions with absolute statutory deadlines; (3) essential litigation-related, administrative, and listing program-management functions; and (4) section 4 listing actions that do not have absolute statutory deadlines. In FY 2010, the Service received many new petitions and a single petition to list 404 species, significantly increasing the number of actions within the second category of our workload—actions that have absolute statutory deadlines. As a result of the petitions to list hundreds of species, we currently have over 460 12-month petition findings yet to be initiated and completed.

To prioritize within each of the four types of actions, we developed guidelines for assigning a listing priority number (LPN) for each candidate species (48 FR 43098, September 21, 1983). Under these guidelines, we assign each candidate an LPN of 1 to 12, depending on the magnitude of threats (high or moderate to low), immediacy of threats (imminent or nonimminent), and taxonomic status of the species (in order of priority: monotypic genus (a species that is the sole member of a genus); species; or part of a species (subspecies or distinct population segment)). The lower the listing priority number, the higher the listing priority (that is, a species with an LPN of 1 would have the highest listing priority). A species with a higher LPN would generally be precluded from

listing by species with lower LPNs, unless work on a proposed rule for the species with the higher LPN can be combined with work on a proposed rule for other high-priority species. This is not the case for rattlesnake-master borer moth. Thus, in addition to being precluded by the lack of available resources, the rattlesnake-master borer moth with an LPN of 8 is also precluded by work on proposed listing determinations for those candidate species with a higher listing priority.

Finally, proposed rules for reclassification of threatened species to endangered species are lower priority, because as listed species, they are already afforded the protections of the Act and implementing regulations. However, for efficiency reasons, we may choose to work on a proposed rule to reclassify a species to endangered if we can combine this with work that is subject to a court-determined deadline.

Since before Congress first established the spending cap for the Listing Program in 1998, the Listing Program workload has required considerably more resources than the amount of funds Congress has allowed for the Listing Program. It is therefore important that we be as efficient as possible in our listing process. Therefore, as we implement our listing work plan and work on proposed rules for the highest priority species in the next several years, we are preparing multi-species proposals when appropriate, and these may include species with lower priority if they overlap geographically or have the same threats as one of the highest-priority species. In addition, we take into consideration the availability of staff resources when we determine which high-priority species will receive

funding to minimize the amount of time and resources required to complete each listing action.

Listing Program Workload. Each FY we determine, based on the amount of funding Congress has made available within the Listing Program spending cap, specifically which actions we will have the resources to work on in that FY. We then prepare Allocation Tables that identify the actions that we are funding for that FY, and how much we estimate it will cost to complete each action; these Allocation Tables are part of our record for this notice and the listing program. Our Allocation Table for FY 2012, which incorporated the Service's approach to prioritizing its workload, was adopted as part of a settlement agreement in a case before the U.S. District Court for the District of Columbia (Endangered Species Act Section 4 Deadline Litigation, No.10-377 (EGS), MDL Docket No. 2165 ("MDL Litigation"), Document 31-1 (D. D.C. May 10, 2011) ("MDL Settlement Agreement")). The requirements of paragraphs 1 through 7 of that settlement agreement, combined with the work plan attached to the agreement as Exhibit B, reflected the Service's Allocation Tables for FY 2011 and FY 2012. In addition, paragraphs 2 through 7 of the agreement require the Service to take numerous other actions through FY 2017—in particular, complete either a proposed listing rule or a not-warranted finding for all 251 species designated as "candidates" in the 2010 candidate notice of review ("CNOR") before the end of FY 2016, and complete final listing determinations within one year of proposing to list any of those species. Paragraph 10 of that settlement agreement sets forth the Service's conclusion that "fulfilling the commitments set forth in this Agreement, along with other commitments

required by court orders or court-approved settlement agreements already in existence at the signing of this Settlement Agreement (listed in Exhibit A), will require substantially all of the resources in the Listing Program.” As part of the same lawsuit, the court also approved a separate settlement agreement with the other plaintiff in the case; that settlement agreement requires the Service to complete additional actions in specific fiscal years — including 12-month petition findings for 11 species, 90-day petition findings for 477 species, and proposed listing determinations or not-warranted findings for 39 species.

These settlement agreements have led to a number of results that affect our preclusion analysis. First, the Service has been, and will continue to be, limited in the extent to which it can undertake additional actions within the Listing Program through FY 2017 beyond what is required by the MDL Settlement Agreements. Second, because the settlement is court-approved, two broad categories of actions now fall within the Service’s highest priority (compliance with a court order): (1) the Service’s entire prioritized workload for FY 2012, as reflected in its Allocation Table, and (2) completion, before the end of FY 2016, of proposed listings or not-warranted findings for most of the candidate species identified in this CNOR (in particular, for those candidate species that were included in the 2010 CNOR). Therefore, each year, one of the Service’s highest priorities is to make steady progress towards completing by the end of 2017 proposed and final listing determinations for the 2010 candidate species—based on its LPN prioritization system, preparing multi-species actions when appropriate, and taking into consideration the availability of staff resources.

The MDL settlement agreements required the Service conduct a status review and make a 12-month finding for the rattlesnake-master borer moth. As specified in the Act, the outcome of a 12-month finding could be warranted, not warranted, or warranted but precluded. The MDL settlement agreements did not require a proposed listing rule be issued if listing the rattlesnake-master borer moth was determined to be warranted. As we have determined above the listing of the rattlesnake-master borer moth is warranted but precluded, we have assigned an LPN of 8 to the rattlesnake-master borer moth. Therefore, even if the Service has some additional funding after completing all of the work required by court orders and court-approved settlement agreements, we would first fund actions with absolute statutory deadlines for species that have lower LPNs. In light of all of these factors, funding a proposed listing rule for the rattlesnake-master borer moth is precluded by court-ordered and court-approved settlement agreements, listing actions with absolute statutory deadlines, and work on proposed listing determinations for those candidate species with a lower LPN.

### Expeditious Progress

As explained above, a determination that listing is warranted but precluded must also demonstrate that expeditious progress is being made to add and remove qualified species to and from the Lists. As with our “precluded” finding, the evaluation of whether progress in adding qualified species to the Lists has been expeditious is a function of the resources available for listing and the competing demands for those funds. (Although we do not discuss it in detail here, we are also making expeditious progress in removing

species from the list under the Recovery program in light of the resource available for delisting, which is funded by a separate line item in the budget of the Endangered Species Program. Thus far, during FY 2013, we completed delisting rules for two species.) As discussed below, given the limited resources available for listing, we find that we are making expeditious progress in FY 2013 in the Listing Program.

We provide below tables cataloguing the work of the Service's Listing Program in FY 2013. This work includes all three of the steps necessary for adding species to the Lists: (1) identifying species that warrant listing, (2) undertaking the evaluation of the best available scientific information about those species and the threats they face, and preparing proposed and final listing rules, and (3) adding species to the Lists by publishing proposed and final listing rules that include a summary of the data on which the rule is based and show the relationship of that data to the rule. After taking into consideration the limited resources available for listing, the competing demands for those funds, and the completed work catalogued in the tables below, we find that we are making expeditious progress to add qualified species to the Lists FY 2013.

In addition to the work the Service has completed towards adding qualified species to the Lists, on May 10, 2011, the Service filed in the MDL Litigation a settlement agreement that incorporated the Service's work plan for FY 2012; the court approved that settlement agreement on September 9, 2011. Paragraph 10 of that settlement agreement provides, "The Parties agree that the timetables for resolving the status of candidate species outlined in this Agreement constitute expeditious progress in adding qualified species to the lists of threatened and endangered species." The Service

also filed a second settlement agreement that required even more work in FY 2012. The Service had already begun in FY 2011 to implement that work required by the work plan, and many of these initial actions in our work plan include work on proposed rules for candidate species with an LPN of 2 or 3. Therefore, both by entering into the first settlement agreement and by completing the listing actions required by both settlement agreements, the Service is making expeditious progress to add qualified species to the lists. As provided for in the settlement agreements and the work plan incorporated into the first agreement, the Service's progress in FY 2013 include completing and publishing the following determinations:

<b>FY 2013 Completed Listing Actions</b>			
Publication Date	Title	Actions	FR Pages
10/2/2012	Proposed Threatened Status for Coral Pink Sand Dunes Tiger Beetle and Designation of Critical Habitat	Proposed Listing Threatened	77 FR 60207-60235
10/2/2012	12-Month Petition Finding, Listing of the Spring Pygmy Sunfish as Threatened, and Designation of Critical Habitat	Notice of 12-month petition finding, Warranted Proposed Listing Threatened	77 FR 60179-60206
10/3/2012	12-month Finding for the Lemmon Fleabane; Endangered Status for the Acuña Cactus and the Fickeisen Plains Cactus and Designation of Critical Habitat	Notice of 12-month petition finding, Not warranted Proposed Listing Endangered	77 FR 60509-60579
10/4/2012	Proposed Endangered Species Status for the Florida Bonneted Bat	Proposed Listing Endangered	77 FR 60749-60776
10/4/2012	Determination of Endangered Species Status for Coquí Llanero Throughout Its Range and Designation of Critical Habitat	Final Listing Endangered	77 FR 60777-60802
10/4/2012	Endangered Species Status for the Fluted Kidneyshell and Slabside Pearlymussel and Designation of Critical Habitat	Proposed Listing Endangered	77 FR 60803-60882

10/9/2012	12-Month Finding on Petitions to List the Mexican Gray Wolf as an Endangered Subspecies or Distinct Population Segment with Critical Habitat	Notice of 12-month petition finding, Not warranted	77 FR 61375-61377
10/10/2012	Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat	Final Listing Endangered and Threatened	77 FR 61663-61719
10/11/2012	Endangered Species Status for Cape Sable Thoroughwort, Florida Semaphore Cactus, and Aboriginal Prickly-apple, and Designation of Critical Habitat for Cape Sable Thoroughwort	Proposed Listing Endangered	77 FR 61835-61894
10/11 /2012	Listing Taylor's Checkerspot Butterfly and Streaked Horned Lark and Designation of Critical Habitat	Proposed Listing Endangered and Threatened	77 FR 61937-62058
10/16/2012	Proposed Endangered Status for the Neosho Mucket, Threatened Status for the Rabbitsfoot, and Designation of Critical Habitat for Both Species	Proposed Listing Endangered and Threatened	77 FR 63439-63536
10/17/2012	Listing 15 Species on Hawaii Island as Endangered and Designating Critical Habitat for 3 Species	Proposed Listing Endangered	77 FR 63927-64018
11/14/2012	90-Day Finding on a Petition to List the Heller Cave Springtail as Endangered or Threatened	Notice of 90-day Petition Finding, Substantial	77 FR 67784-67789
11/28/2012	Status Review for a Petition to List the Ashy Storm-petrel as Endangered or Threatened	Notice Status Review	77 FR 70987-70988
12/04 /2012	90-Day Finding on a Petition To List Phoenix dactylifera 'Sphinx' (Sphinx Date Palm)	Notice of 90-day Petition Finding, Not substantial	77 FR 71757-71758
12/04/2012	90-Day Finding on a Petition to List the Prairie Gray Fox, the Plains Spotted Skunk, and a Distinct Population Segment of the Mearn's Eastern Cottontail in East-central Illinois and Western Indiana as Endangered or Threatened Species	Notice of 90-day Petition Finding, Not substantial Substantial	77 FR 71759-71771
12/11/2012	Listing the Lesser Prairie-Chicken as a Threatened Species	Proposed Listing Threatened	77 FR 73827-73888

12/11/2012	Listing Four Subspecies of Mazama Pocket Gopher and Designation of Critical Habitat	Proposed Listing Threatened	77 FR 73769-73825
1/11/2013	Endangered Status for Gunnison Sage-grouse	Proposed Listing Endangered	78 FR 2486-2538
1/25/2013	Endangered Status for the Zuni Bluehead Sucker	Proposed Listing Endangered	78 FR 5369-5385
2/4/2013	Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States	Proposed Listing Threatened	78 FR 7863-7890
3/19/2013	Status Review of the West Coast Distinct Population Segment of the Fisher as Endangered or Threatened	Notice of Status Review	78 FR 16828-16829
3/28/2013	12-Month Finding on a Petition to List the Rosemont Talussnail as Endangered or Threatened	Notice of 12-month petition finding, Not warranted	78 FR 18936-18938
4/9/2013	90-Day Finding on a Petition to List Two Populations of Black-Backed Woodpecker as Endangered or Threatened	Notice of 90-day Petition Finding, Substantial	78 FR 21086-21097
4/23/2013	Threatened Status for Eriogonum codium (Umtanum Desert Buckwheat) and Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod)	Final Listing Threatened	78 FR 23983-24005
4/25/2013	Endangered Status for the Sierra Nevada Yellow-legged Frog and the Northern Distinct Population Segment of the Mountain Yellow-legged Frog, and Threatened Status for the Yosemite Toad	Proposed Listing Endangered and Threatened	78 FR 24471-24514
5/24/2013	Proposed Threatened Status for Leavenworthia exigua var. laciniata (Kentucky Glade Cress)	Proposed Listing Threatened	78 FR 31498-31511
5/28/2013	Determination of Endangered Status for 38 Species on Molokai, Lanai, and Maui	Final Listing Endangered	78 FR 32013-32065
6/20/2013	Listing Determination for the New Mexico Meadow Jumping Mouse	Proposed Listing Endangered	78 FR 37363-37369
7/9/2013	Determination of Endangered Species Status for Six West Texas Aquatic Invertebrates	Final Listing Endangered	78 FR 41227-41258
7/10/2013	Threatened Status for the Northern Mexican Gartersnake and Narrow-headed Gartersnake	Proposed Listing Threatened	78 FR 41499-41547

Our expeditious progress also included work on listing actions that we funded in

previous fiscal years, and in FY 2013, but have not yet been completed to date. For these species, we have completed the first step, and have been working on the second step, necessary for adding species to the Lists. These actions are listed below. Actions in the top section of the table are being conducted under a deadline set by a court through a court order or settlement agreement. Actions in the lower section of the table are being conducted to meet statutory timelines, that is, timelines required under the Act.

<b>Actions funded in Previous FYs and FY 2013 but not yet completed</b>	
<b>Species</b>	<b>Action</b>
<b>Actions Subject to Court Order/Settlement Agreement</b>	
Gierisch's mallow ( <i>Sphaeralcea gierischii</i> )	Final listing
4 Texas salamanders (salado, Georgetown, Jollyville plateau, and Austin blind)	Final listing
Jemez Mountains salamander	Final listing
2 Texas plants (Texas golden glade cress and Neches River rose-mallow)	Final listing
Grotto sculpin	Final listing
Mount Charleston blue butterfly	Final listing
Spring pygmy sunfish	Final listing
Coral pink sand dunes tiger beetle	Final listing
3 Arizona plants ( <i>Echinomastus erectocentrus</i> var. <i>acutensis</i> , <i>Erigeron lemmonii</i> , <i>Pediocactus peeblesianus fiskeiseniae</i> )	Final listing
2 Tennessee River mussels (fluted kidneyshell and slabside pearly mussel)	Final listing
Florida bonneted bat	Final listing
4 Puget trough species (4 subspecies of pocket gopher ( <i>Thomomys mazama</i> ssp.) (LPN =3))	Final listing
3 Sierra amphibians (Yosemite toad, mountain yellow-legged frog – Sierra Nevada DPSs)	Final listing
3 southern Florida plants (Florida semaphore cactus, aboriginal prickly-apple, Cape Sable thoroughwort)	Final listing
2 Puget trough species (Taylor's checkerspot, streaked horned lark)	Final listing
Lesser prairie chicken	Final listing
Gunnison sage-grouse	Final listing
15 Hawaiian big island species	Final listing

2 Arkansas mussels (neosho mucket and Rabbitsfoot)	Final listing
Red knot (LPN = 3)	Proposed listing
Dakota skipper (LPN = 8) and Poweshiek skipperling (LPN = 2)	Proposed listing
Vandenberg monkeyflower	Proposed listing
Yellow-billed cuckoo (western U.S. DPS)	Proposed listing
2 Brazos River fish (smalleyed shiner and sharpnose shiner)	Proposed listing
Georgia rockcress	Proposed listing
2 Sierra plants (webber ivesia, soldier meadows cinquefoil)	Proposed listing
Oregon spotted frog	Proposed listing
2 Florida butterflies (Bartram's hairstreak and Florida leafwing)	Proposed listing
Greater sage-grouse, bi-State DPS	Proposed listing
3 species Caribbean plants ( <i>Cordia rupicola</i> , <i>Gonocalyx concolor</i> , <i>Agave eggersiana</i> )	Proposed listing
Canada lynx – New Mexico	Proposed listing
White River beardtongue	Proposed listing
2 Florida pine rockland plants (Carter's small-flowered flax and Florida brickell-bush)	Proposed listing
3 Southeast plants (whorled sunflower, gladecress, and Short's bladderpod)	Proposed listing
Washington ground squirrel	Proposed listing
2 San Diego plants (Orcutt's hazardia and Brand's Phacelia)	Proposed listing
Xantus's murrelet	Proposed listing
Kittlitz's murrelet	Proposed listing
Yellow-billed loon	Proposed listing
Florida bristle fern	Proposed listing
Ashy storm-petrel	12-month petition finding/proposed listing
Eastern small-footed bat and northern long-eared bat	12-month petition finding/proposed listing
Rattlesnake-master borer moth	12-month petition finding
<b>Actions with Statutory Deadlines</b>	
Alexander Archipelago wolf	90-day petition finding

Another way that we have been expeditious in making progress to add qualified species to the Lists is that we have endeavored to make our listing actions as efficient and timely as possible, given the requirements of the relevant law and regulations, and constraints relating to workload and personnel. We are continually considering ways to

streamline processes or achieve economies of scale, such as by batching related actions together. Given our limited budget for implementing section 4 of the ESA, these efforts also contribute towards finding that we are making expeditious progress to add qualified species to the Lists.

The rattlesnake-master borer moth will be added to the list of candidate species upon publication of this 12-month finding. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

We intend that any proposed listing action for the rattlesnake-master borer moth will be as accurate as possible. Therefore, we will continue to accept additional information and comments from all concerned governmental agencies, the scientific community, industry, or any other interested party concerning this finding.

The rattlesnake-master borer moth will be added to the list of candidate species upon publication of this 12-month finding. We will continue to evaluate this species as new information becomes available. Continuing review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

We intend that any proposed listing determination for the rattlesnake-master borer moth will be as accurate as possible. Therefore, we will continue to accept additional

information and comments from all concerned governmental agencies, the scientific community, industry, or any other interested party concerning this finding.

### **References Cited**

A complete list of references cited is available on the Internet at *<http://www.regulations.gov>* and upon request from the Rock Island, Illinois Ecological Services Field Office (see **ADDRESSES** section).

### **Author(s)**

The primary author(s) of this notice are the staff members of the Rock Island, Illinois Ecological Services Field Office.

## Authority

The authority for this section is section 4 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

August 5, 2013

Rowan W. Gould

Acting Director, Fish and Wildlife Service

~~[Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Rattlesnake-master Borer Moth (*Papaipema eryngii*) as an Endangered or Threatened Species]~~

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